THE AEROPLANE and ASTRONAUTICS

JULY 11

BRITISH UNITED AIRWAYS CHOOSES

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BAC ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

BRITISH AIRCRAFT CORPORATION

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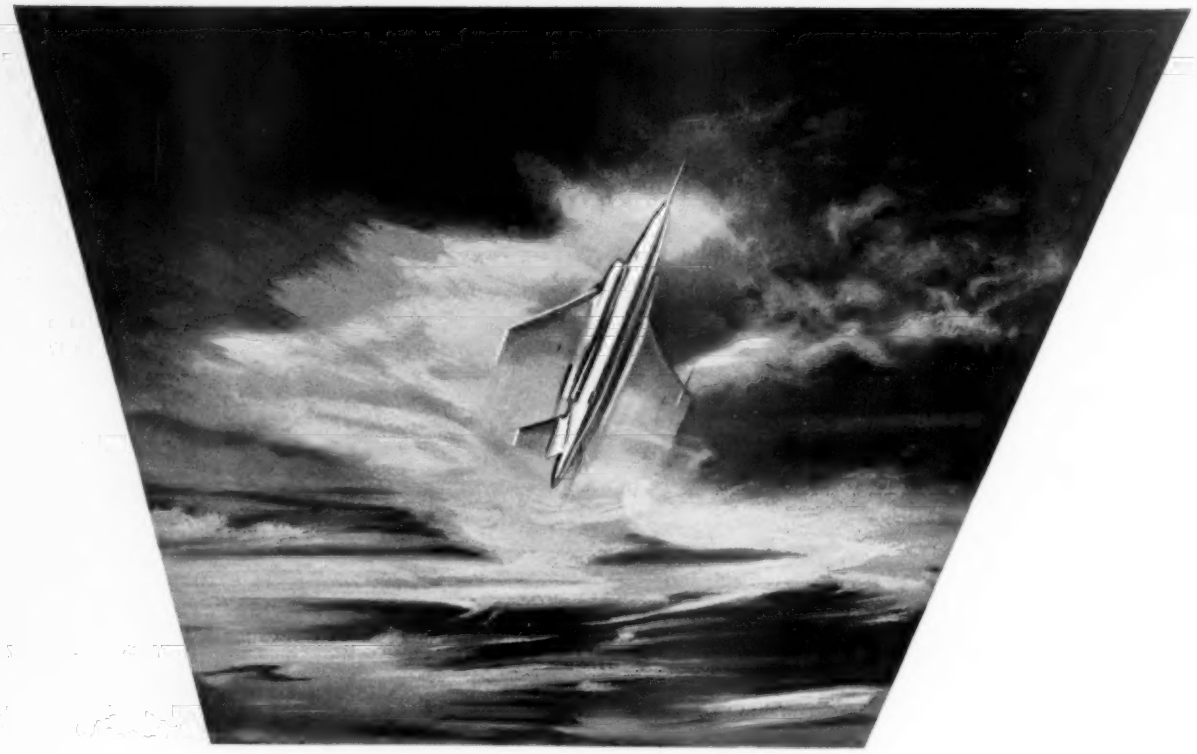

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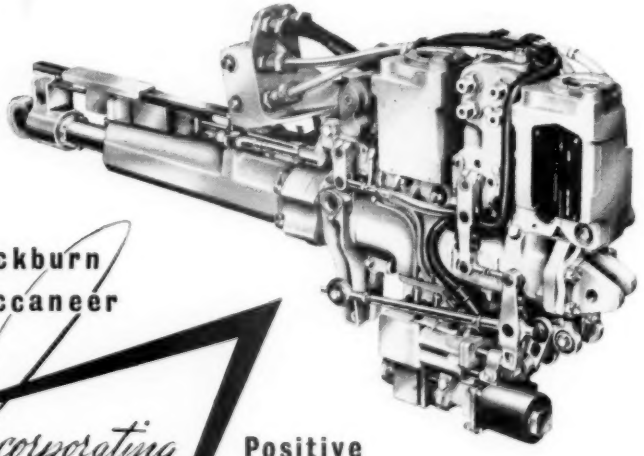

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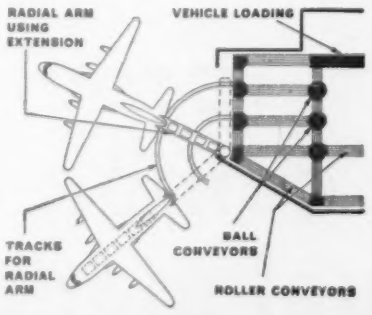

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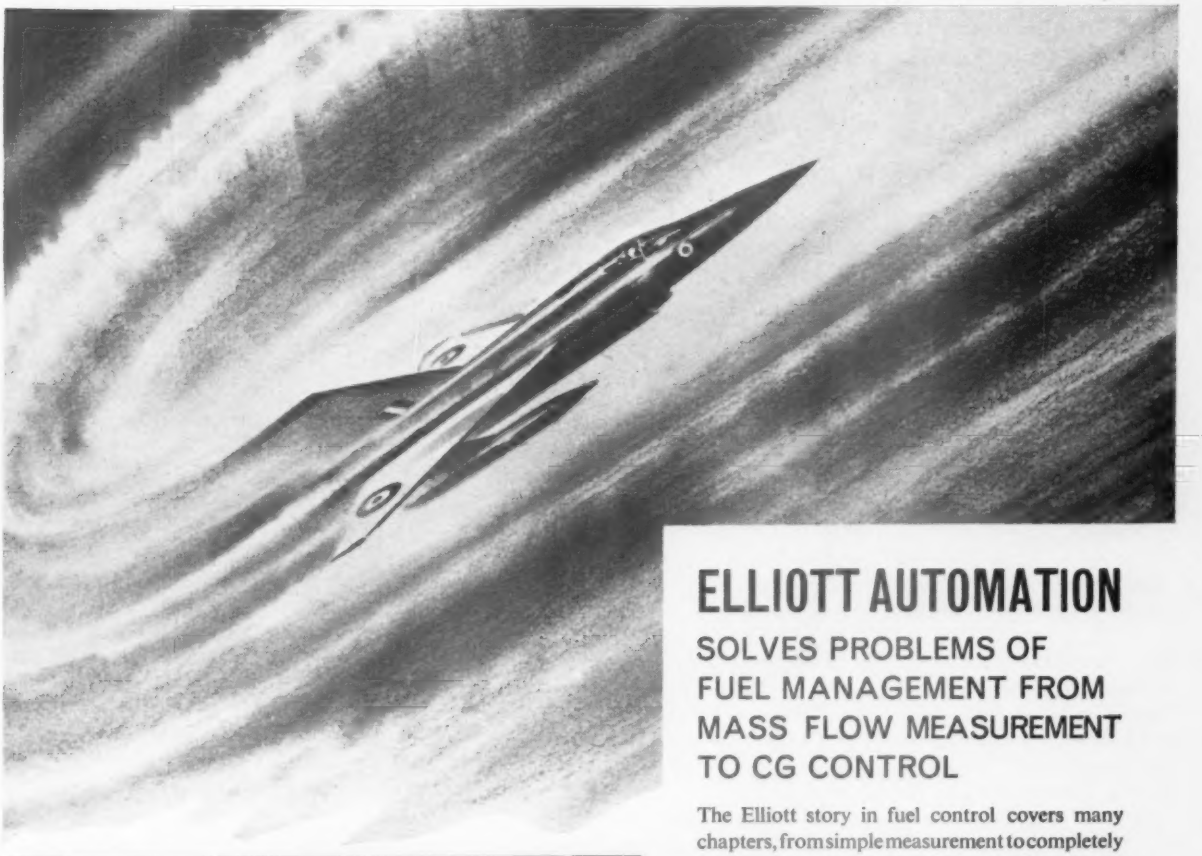

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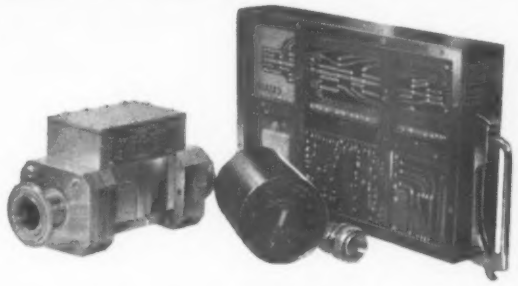

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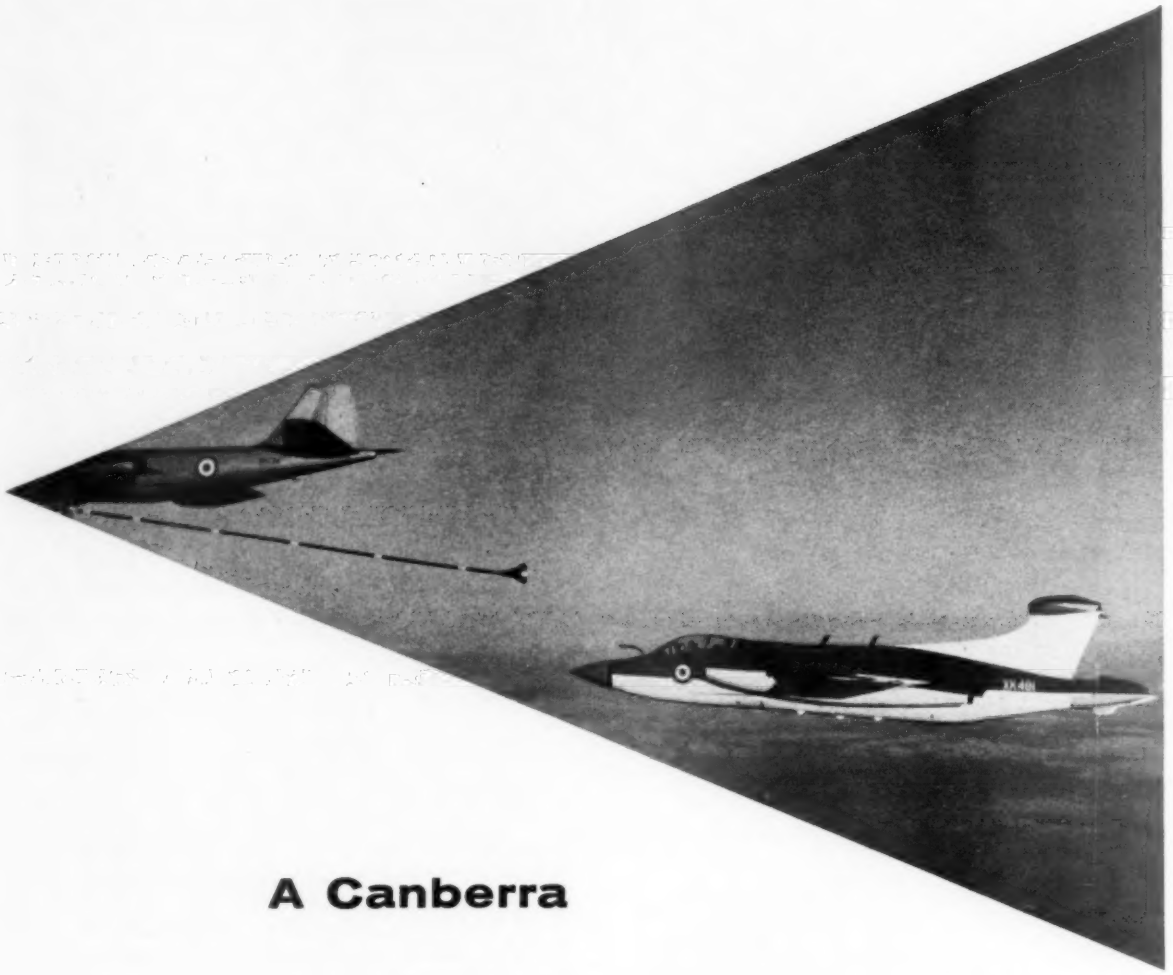

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THE AEROPLANE and ASTRONAUTICS

VOLUME 101 NUMBER 2597 JULY 27, 1961

Towards the Goal

Exactly how many years ago we first began arguing the case for an Airport of London Authority to run Heathrow and Gatwick we cannot pretend to recall. It is illuminating to note that when an editorial on the subject appeared on Oct. 7, 1960, this referred, in its turn, to a previous editorial dated Mar. 27, 1959. Now the Select Committee on Estimates has, as *The Times* says, "thrown its weight behind the idea." At the rate at which things move in this country even the weight of a ponderous body such as the Committee is not going to be able to provide the huge inertia of the Ministry of Aviation with any vastly accelerated motion. However, in case we may sound ungracious, let us say without any equivocation that we welcome evidence that the idea of organizing the running of London Airports outside the slow-moving mechanism of the Civil Service is at last becoming respectable. It is high time that it did. Mr. Thorneycroft made it clear very soon after his appointment that he favoured the idea; it is comforting to know that we may now expect to see something done before VTOL aircraft make long runways out of date—which might reasonably be the case in about 10 years' time.

Another important point taken up by the Select Committee is one which has frequently been aired in our columns and that is the question of penalizing the car owner who is sanguine enough to drive himself to L.A.P. in his own motorcar. Not only will he have an anxious half-hour trying to find somewhere to park, he will immediately find that the last thing any official body wants him to do is to bring himself to London Airport and so get the full benefit out of air travel.

Of course, putting all the passenger handling accommodation within an island site at L.A.P. does not facilitate solution of the car parking problem. True, putting two or three storeys over the existing site would double or treble the present capacity, but that is not going to be enough. This problem is certainly one the Airport of London Authority will have to tackle without delay when it gets on the scene.

We wonder whether by the time the new Authority is constituted, the United Kingdom will have a duty-free shop on its terminal airports; it is strange that a country which is alleged to survive and exist by virtue of its export trade should be so slow in following the examples which any traveller by air encounters *seriatim*.

Do not let us depress ourselves or our readers further. Let us welcome the Select Committee's observations and express the hope that their implementation may come quickly.

Off to a Good Start

When the first General Meeting of the Business Aircraft Users Association was held on Jly. 21 the report laid before members showed excellent progress made in the eight weeks since it came into being. The Flying and Legislation Committee has decided that the first three problems to be tackled are, in order of priority, aerodromes, use of airspace and Customs facilities.

As regards the first problem B.A.U.A. has decided that the reopening of Croydon Airport for business aviation is going to be the best answer for the foreseeable future. Main concentration of effort has been towards this end. We understand that the outlook is not unpromising.

The new Association has demonstrated that it has got away to a good start; no aspect of its work will be watched more keenly than its success in the opening up of airfields for the business user. And, of course, a must is the provision of suitable arrangements with the A.T.C. authorities so that such bases shall be of practical value.

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Matters of Moment

Memorable Unveiling

"THAT great man to whom the Royal Air Force and the country owe so much." Thus the Prime Minister, quoting Her Majesty's own words, described Lord Trenchard when he unveiled a monument erected to his memory in front of the Air Ministry on Jly. 19.

The ceremony of unveiling the monument by Mr. Macmillan and its dedication by the Archbishop of Canterbury, Dr. Ramsey, was attended by a large and distinguished gathering not only from the R.A.F. of the present and past but by representatives from the other Services and Ministries and, of course, the Metropolitan Police whose chief Lord Trenchard became long after most lesser men would have retired from active public service. Indeed, the siting of the monument in front of the Air Ministry on the Embankment happily places it within easy sight of his former H.Q. at Scotland Yard as well.

A very large gathering of senior officers of Lord Trenchard's era—donning uniform again—were present to pay tribute. One particularly noticed the presence of Sir John Salmond, a colleague of his of pre-1914 days in Regular Army operations in Africa and elsewhere; with him as an instructor at C.F.S.; and his successor as Chief of Air Staff. And, in the next generation, one saw Marshal of the Royal Air Force, Sir Dermot Boyle—Cranwell cadet to C.A.S.—first distinguished product of the Trenchard planning.

The effigy itself is a striking and impressive piece of work. The stance and the tilt of the head is that of "Boom." But those of us who grew up in the happy but terribly stern discipline of his early R.A.F. shuddered a little to see him depicted in full uniform without a hat and with an open greatcoat.—

C. A. SIMS.

Second Manned "Sub-orbital"

DESPITE the mishap which led to the sinking of America's second manned Mercury capsule at the end of the mission on Jly. 21, the much delayed launching appears to have been in every way as successful as Cdr. Shepard's in the capsule Freedom 7. Lift-off took place at Cape Canaveral at 07.20 hrs. local time with the Redstone booster serving to drive the Liberty Bell capsule and astronaut Capt. Virgil Grissom to a speed of 5,280 m.p.h., a height of 118 miles and a distance of 303 miles. Trouble developed after the capsule had alighted.

Ironically, the cause was a modification designed to *increase* the safety of the Mercury astronaut. Unlike the mechanically operated side hatch on Cdr. Shepard's Freedom 7, the Liberty Bell was equipped with a hatch secured by 70 explosive bolts as a means of ensuring easy and rapid exit in emergency. Release is effected by pushing a plunger button inside the spacecraft or by pulling a cable.

According to reports, what actually happened was that Capt. Grissom had armed the escape hatch as part of his "drill" by withdrawing a pin. Two and a half minutes later—without any action on the part of the astronaut—the door suddenly blew off and water immediately started to flood in. Grissom straightaway entered the sea, still clad in his 20-lb. pressure suit, and was retrieved by a Sikorsky HUS-1 helicopter.

Meanwhile, a second helicopter had managed to get a line attached to the waterlogged capsule and managed to keep it afloat for some time, but in the end had to give up the struggle owing to overheating of its engine. Reluctantly, the supporting line was cut and Liberty Bell sank in 2,800 fathoms.

Other, less troublesome, capsule changes were as follows:—

There was an enlarged "pilot observation window" which replaces two 6-in. circular ports used in Freedom 7. Located directly above the astronaut, this permitted a direct view of the horizon, thereby allowing visual determination of the spacecraft's attitude (also possible with the periscope).

Reference lines were inscribed on the four-pane window to assist the pilot in holding the capsule precisely in the required 34° nose-up attitude at apogee during firing of the retro-rockets. After the rockets had fired, the astronaut was expected to switch to another new system of manual control being flight-tested for the first time. This is the Rate Stabilization and Control System (RSCS).

In the case of the manual system used by Cdr. Shepard, the hand controller served directly to open and close six gas jets at the base and neck of the capsule to orientate the craft on three axes. Liberty Bell had a similar system but, in this case the pilot could select to switch to RSCS, when his hand action would be translated into electrical signals which served to open and close solenoid valves controlling the jets.

THE FATHER OF THE R.A.F.—Unveiled by the Prime Minister and dedicated by the Archbishop of Canterbury, this striking statue of Lord Trenchard now stands in front of the Air Ministry on the Embankment. A view of the ceremony is at the foot of the opposite page.

An alteration had also been made where the capsule intersects with the Redstone booster as a means of reducing vibrations which have been found to occur during transonic flight and at "Max Q," the point at which the highest airloads are imposed on the Redstone-Mercury. This amounted to streamlining the three-piece clamp ring fairing, a modification which was successfully flight-tested in the Little Joe launching at Wallops Island on Mar. 18, 1961.

Astronautics at Southampton

BY converting its Aeronautics Department into a "Department of Aeronautics and Astronautics," Southampton is the first British university to dignify this new subject by official recognition. This was pointed out by Prof. M. J. Lighthill, Director of the Royal Aircraft Establishment, when he opened a week's "Seminar on Astronautics" at the university in mid-July.

At R.A.E., Prof. Lighthill revealed, at least 160 people, or more than one-tenth of the staff, are still working on space projects, though before the cancellation of the Blue Streak rocket there were 200 working on that alone. Black Knight, a two-step rocket of which the second step ignites on the way down, was designed by R.A.E. for research on re-entry problems, for the specific reason that films must be brought back to Earth to get the best results from rocket research into the Earth's atmosphere from above.

Prof. Lighthill introduced a new word when he distinguished "plasmanautics," which means travel through the "plasma" of protons and electrons outside our atmosphere, from "pure space travel" in which space is regarded as a vacuum and only geometrical considerations apply. Aeronautics and plasmanautics should not be separated.

Finally Prof. Lighthill had some wise words on international collaboration in science, the alleged difficulties of which, he said, do not exist unless they are deliberately created. Such

collaboration on advanced projects attracts the best men from many countries, but it is "not to be achieved by setting up a huge new organization in Switzerland" every time a new project is proposed. What is wanted is "some mechanism for sharing out the job" and another mechanism for co-ordinating, which should be done by a single institution in a particular country for each project—though maybe in different countries for different projects.

Most of the 22 papers in the seminar were reviews of their subjects rather than announcements of new research.

Prof. E. J. Richards, head of the Department, Dr. B. L. Clarkson, the organizer, and A.G.A.R.D., who helped to bring lecturers from Italy, France and the U.S.A., including California, all deserve congratulations on the success of this seminar.—A.E.S.

More About Tushino

WHILE the repercussions of the Russian revelations at Tushino are still echoing, an account of the programme, from Soviet sources, is of some significance. After opening items by light aircraft and Mi-1, -4 and -6 helicopters, a modified version of the last-mentioned type, flown by R. Kaprelyan, with a 15-ton payload as a flying-crane, lifted a prefabricated hut of the type used by Soviet scientists in the Antarctic.

A formation of the massive Mi-6 helicopters, led by Col. I. A. Melnichuk, and in SovAF markings, was the first intimation of the military use of this type. They landed troops, surface-to-surface missiles and towing vehicles on the airfield. The rotorcraft demonstrations ended with the first appearances of a new co-axial naval rocket-carrying helicopter developed from the Ka-18, and the Kamov Vintokryl convertiplane (a new photograph of which appears on p. 95 of this issue).

The DOSAAF (or para-military sports flying organization) display, included aerobatics by the Antonov A-11 and A-13 sailplanes, Yak-18Ps (back-to-back), Yak-18As, and the new Yak-30 light jet trainers. Five of these flew past, led by Y. Vernikov, and are apparently two-seat versions of the Yak-32 which recently established a class record in Russia.

Aeroflot exhibited a Tu-114, three Tu-124s, a Tu-104, an Il-18, an An-10A and an An-24. Parachuting took place from An-2s, and from a formation of 30 four-engined turboprop transports derived from the An-10 (An-12s).

Fly-pasts of new aircraft were opened by Maj. V. Shvetsov in a MiG-19, followed by formation aerobatics in what were described as E-66 supersonic fighters. There were several groups of formation aerobatics, but it is impossible to identify the types of fighters involved. What is clear is that there were four different and distinct types of delta fighters shown, all carrying missiles, and all but one single engined, plus a closely similar type of interceptor with sharply swept wings. These designs have been attributed to Sukhoi and Mikoyan, but who designed what is far from clear. The NATO code-names, Fishpot, Fishbed and Fitter, which have been applied to some of these types tend only to add to the confusion.

An important lead to the SovAF participation, which lasted 34 minutes, and also included a number of other missile-carrying types such as Beauty, Bear (Tu-20), Badger (Tu-16), Flashlight B and C developments (Yak-25), swept-wing versions of the Beriev jet flying-boat, and improved Backfins, was the mention of those design bureaux represented. On the airframe side, these comprised the teams headed by A. N. Tupolev, P. O. Sukhoi, A. I. Mikoyan, V. M. Myasishchev and A. S. Yakovlev, while powerplants were the work of the A. M. Lyulka and S. K. Tumansky offices.

Rocket-boosted versions of some of the delta fighters were flown. Final item was the JATO launching of one of the new interceptors.

Air Matters in Parliament

Uncivil Aviation?

LONDON AIRPORT was under fire again in the House of Commons on Jly. 10, this time in respect of the handling, or mishandling, of passengers. MR. F. NOEL-BAKER (Lab., Swindon) asked the Minister of Aviation what was the average time between an arriving passenger aircraft coming to rest and completion of immigration and Customs facilities. MR. GEOFFREY RIPPON, Parliamentary Secretary to the Ministry of Aviation, replied that it was 35 minutes at the North terminal and less than 20 at the Central.

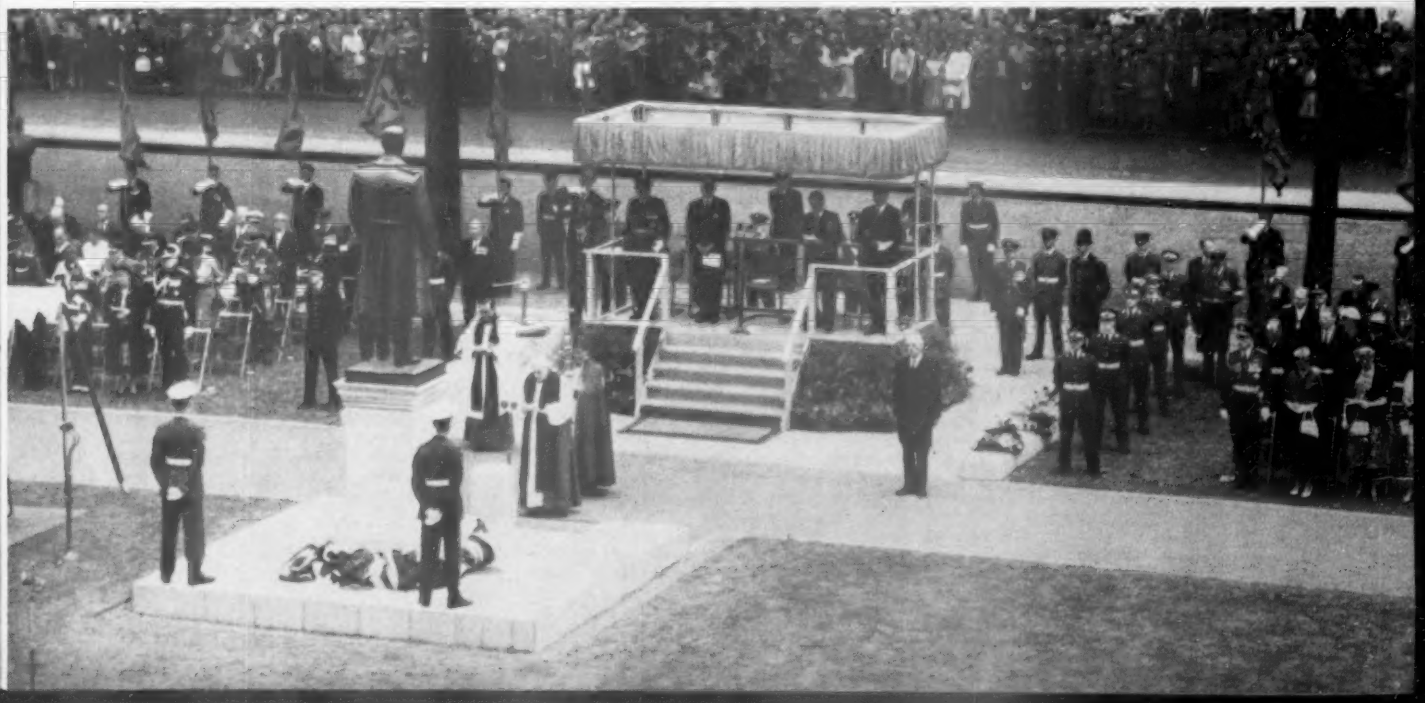
This, said Mr. Noel-Baker, compared badly with other airports in western Europe—for instance, the time at Copenhagen has recently been 11 minutes between touch-down and leaving the terminal building. SIR ARTHUR HARVEY (Cons., Macclesfield) said the figures for London Airport were misleading, in that times were often far longer at the evening peak hour. Mr. Rippon hoped for improvement at the new long-haul building.

Cause for reproach from a different angle was voiced by MR. J. W. W. PEYTON (Cons., Yeovil). "Far too often, quite apart from the limitations of buildings," he said, "the handling of passengers is slovenly and discourteous, and it is high time that this is polished up."

Aircraft Carriers

On Jly. 12 MAJ. P. H. B. WALL (Cons., Haltemprice) asked the Civil Lord of the Admiralty at what date existing aircraft carriers would become obsolete, and what plans he had for replacement. MR. C. I. ORR-EWING replied that our present five carriers will all have first-class capability at least until the early 1970s, and that replacement plans are still in the study stage. On Mr. Wall suggesting that it might be better when the time came, from the standpoints both of defence and of cost, to build no more aircraft carriers but to lay down missile submarines instead, Mr. Orr-Ewing instanced recent events in Kuwait as demonstrating how valuable is an aircraft carrier in providing cover and control facilities.

MR. E. G. WILLIS (Lab., Edinburgh, E.) sought an assurance that the House would have an opportunity to debate the issue before a decision is taken. This was not forthcoming, but the Civil Lord made it clear that some time will elapse before a programme is formulated, and added that the useful first life of an aircraft carrier is reckoned to be 20 years, which can be extended for a further 10 years by major modernization.



OPtional Reading—4

I WAS suckled by as noble (though, perhaps, not as elegant) a mother as you would get, the good old Valentia, whose wing area was measured in acres, but when in 1941 it came to weaning on to the Wellington 1A (one hour's instruction for two pupils, my log book shows—times were hard in those days for sandwich courses), I damaged a tail-frame on my first solo landing. Now my recollection of that occasion is coming in at the "book speed," cutting the throttles just before the hedge, and heaving back on the stick, just as on the Valentia. But it wasn't a Valentia, and the thing kept coming on down—not fully stalled, because the nose came up and we touched down first on the tail wheel—and we hit with a bit of a biff. After that I changed my technique, making always a flatter approach, maintaining "book speed" plus 5 or 10 kts. for "mum" and carrying a little engine till after the flare. This method would almost certainly not have been favoured by the designer when specifying landing distance, but it saw me through subsequent years, subsequent types, into-wind landings and cross-wind landings, all without incident (though there was one innocuous trundle into the mud after a down-wind landing on a wet Laterite surface).

Now at this early stage in the history of the column I do not propose to dwell on reminiscences (that may come later, if controversy on the following subject gets too hot!). I mention the incident to show that the tendency of aeroplanes to "keep going on down" after the pilot has initiated the flare-out is by no means new. It used to be called the "mush effect." Today it is very rare to hear this simple and descriptive word; however, it is not rare to be brought in with a clang. Indeed, I believe that there is a lot in what a pilot friend of mine said the other day: "The days of good landings are over."

Perhaps this would not matter if it were just a question of the passengers getting a shake (look what a shaking you take on a London bus!), but the fact is that hitting the ground hard, either on *or before* the runway, is the major source of accidents today. It is also a very likely cause of many of the incidents now so frequently reported in the newspapers (undercarriage would not come down, loss of hydraulic fluid causing loss of brakes, tyre burst) and of more which do not get into the newspapers (leaking fuel tank, prematurely fatigued engine-mounting). One might think, therefore, that the matter was worth some investigation. But, somewhat strangely, there has been very little—or at least little has been published on it. ICAO to some extent has paid attention to the approach problem by setting up the Visual Aids Panel, and the R.A.E. has helped by producing the visual approach slope indicator; similarly, the Flight Safety Foundation sponsored a study on the undershoot problem. But valuable though these efforts have been, they have all started off from the preconceived idea that the predominant landing problem is a visual problem, how to keep the aircraft on or near to the optimum glide slope all the way from turning final to aerodrome threshold. No one, so far as I know, has really gone into the aerodynamic and ballistic situation existing at or near the flare-out point.

Theories do, of course, exist. For example, apart from the above "visual theory" there is the "ballistic theory," which says that it is natural for a heavy aeroplane to "keep going on down" at the flare-out point unless you ensure that the rate of sink on final approach is not greater than 600 ft. per minute; there is the "geometric theory," which says that the main gear of a modern aircraft, being well aft of the centre of rotation, prescribes an arc at the flare-out point, driving the gear into the runway; there is the "aerodynamic theory," which says that it must be expected that elevators of a modern aircraft become somewhat less efficient as a high angle of attack is assumed. But none of these theories has, so far as I know, ever been the subject of a published study; and nobody appears to have investigated how far, if at all, a general formula for "flare-out" technique might be evolved.

Boeings may, of course, have the answer in their advice on the 720: don't flare the thing at all—just allow it to settle on to the runway. They may well be right about this; but, if so, I would like to know if it can be applied to the Convair 990, to the Comet, the DC-8 and the rest. And, if not, why not? Does the 720 catch a favourable ground effect (as was reported years ago for the Victor, but of which one hears strangely little these days)? Does the 990 not catch this effect but hopes to do so with the Kreuger leading-edge flaps? These are all questions very relevant to the landing problem and as this is agreed as the cardinal problem of today's operations, we are surely entitled to some authoritative answers. Gagarin was well justified to say on landing: "I feel well; I have no injuries or bruises," but surely today's civil passenger should not even be reminded of the thought.

So until someone gives me the statistical measure of wind speed variability near the ground, the A.S.I. position error at full flap and high angles of attack, the A.S.I. system and instrumental variabilities, the true margin of the equivalent airspeed over the *one-g stall*, the temporary increase in stalling speed due to the extra loading of the round-out action and the value of ground effect from 50 ft. downwards, I will continue to believe that many of today's landing problems are due to yesterday's "mush effect."—C.C.J.

Proving the 748's Airframe

FROM Hawker Siddeley Aviation has come some information about the structural test programme that has been conducted on the Avro 748 airframe. Readers will recall that in the detail design of this new short-medium range civil turboprop transport, particular attention was paid to obtaining a fully fail-safe structure (see THE AEROPLANE AND ASTRONAUTICS for Feb. 12, 1960). The test programme intended to prove this integrity has been in progress since January, 1960.

First on the list were tests to establish the strength of the fuselage frames and floor beams when subjected to the severe loads that might be experienced in a crash landing. Later a section of the wing, including leading- and trailing-edges, was tested to demonstrate the strength of a typical wing rib both before and after the rib had been artificially damaged.

An engine sub-frame and undercarriage unit mounted on local wing structure was subjected to tests earlier this year. For this, engine and undercarriage loads representing seven design cases were applied to prove compliance with A.R.B. requirements.

While this "localized" structural testing was in progress, a fuselage complete with wings and tailplane was assembled in the static structural test frame. Tests with this airframe structure started in April, 1961, to simulate the most severe conditions encountered during the take-off, in-flight and landing regimes.

Loads were applied to the structure by hydraulic jacks using the normal system of linkages to spread the load over the whole wing to give an accurate representation of flight conditions. One of the integral fuel tanks in the wing was sealed during these tests and loads were applied with this tank full.

The landing case was the first to be investigated with this complete aircraft structure, for this controlled the design of the rear fuselage and wing rear spar. After this test was satisfactorily accomplished the principal flight loading case—a 66-ft. per sec. gust case—was dealt with. This particular case controls the design of the whole wing, in bending and of most of the front fuselage.

In the test, the loading was increased to 103% of the ultimate design load without failure.

A schedule of fatigue tests has also been in progress on the Avro 748. In August, 1960, a complete cabin structure was immersed in a new water tank at the main Avro works. This specimen was pressurized to a cabin differential of 12.1 p.s.i. During this test schedule, the fuselage withstood over 10,000 pressurization cycles.

A complete airframe has now been installed in the water test tank and will shortly be subjected to full-scale fatigue testing.

A Worthy Cause

THIS year the Royal Air Force Benevolent Fund has reached the point where it has expended more than £10 million since its foundation in 1919. All this money has been spent on the relief of distress among serving and ex-Service members of the R.A.F., the W.R.A.F. and their families and dependents. Much of the credit for the Fund's noteworthy work in the post-war years must go to its energetic Controller, Air Vice-Marshal Sir John Cordingley, K.C.B., C.B.E., R.A.F. (retd.), shortly to retire from active participation in the Fund's affairs.

He reminds us that last year, in order to achieve its aims and objects, the Fund spent £527,979—an average of more than £10,000 each week and an increase on the previous year when £495,500 had been spent. There were, he says, 12,585 successful applications for aid in 1960—bringing the total of such applications since 1919 to the remarkable figure of 443,814.

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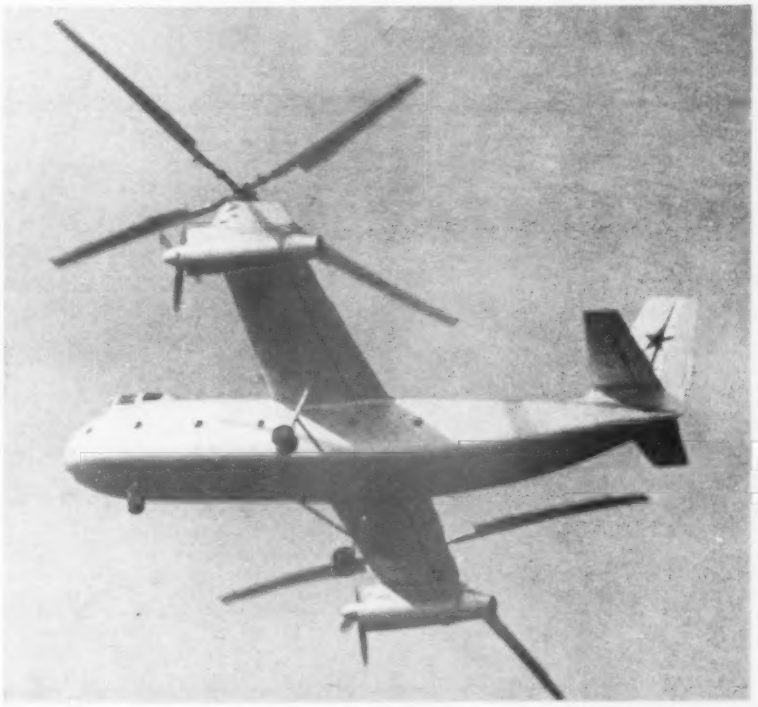

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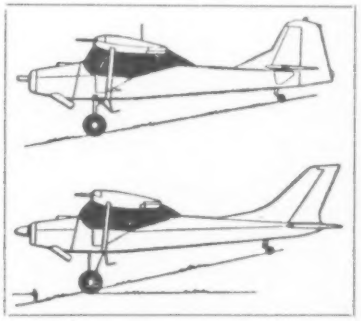

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OPtional Reading—4

I WAS suckled by as noble (though, perhaps, not as elegant) a mother as you would get, the good old Valentia, whose wing area was measured in acres, but when in 1941 it came to weaning on to the Wellington IA (one hour's instruction for two pupils, my log book shows—times were hard in those days for sandwich courses), I damaged a tail-frame on my first solo landing. Now my recollection of that occasion is coming in at the "book speed," cutting the throttles just before the hedge, and heaving back on the stick, just as on the Valentia. But it wasn't a Valentia, and the thing kept coming on down—not fully stalled, because the nose came up and we touched down first on the tail wheel—and we hit with a bit of a biff. After that I changed my technique, making always a flatter approach, maintaining "book speed" plus 5 or 10 kts. for "mum" and carrying a little engine till after the flare. This method would almost certainly not have been favoured by the designer when specifying landing distance, but it saw me through subsequent years, subsequent types, into-wind landings and cross-wind landings, all without incident (though there was one innocuous trundle into the mud after a down-wind landing on a wet Laterite surface).

Now at this early stage in the history of the column I do not propose to dwell on reminiscences (that may come later, if controversy on the following subject gets too hot!). I mention the incident to show that the tendency of aeroplanes to "keep going on down" after the pilot has initiated the flare-out is by no means new. It used to be called the "mush effect." Today it is very rare to hear this simple and descriptive word; however, it is not rare to be brought in with a clang. Indeed, I believe that there is a lot in what a pilot friend of mine said the other day: "The days of good landings are over."

Perhaps this would not matter if it were just a question of the passengers getting a shake (look what a shaking you take on a London bus!), but the fact is that hitting the ground hard, either on *or before* the runway, is the major source of accidents today. It is also a very likely cause of many of the incidents now so frequently reported in the newspapers (undercarriage would not come down, loss of hydraulic fluid causing loss of brakes, tyre burst) and of more which do not get into the newspapers (leaking fuel tank, prematurely fatigued engine-mounting). One might think, therefore, that the matter was worth some investigation. But, somewhat strangely, there has been very little—or at least little has been published on it. ICAO to some extent has paid attention to the approach problem by setting up the Visual Aids Panel, and the R.A.E. has helped by producing the visual approach slope indicator; similarly, the Flight Safety Foundation sponsored a study on the undershoot problem. But valuable though these efforts have been, they have all started off from the preconceived idea that the predominant landing problem is a visual problem, how to keep the aircraft on or near to the optimum glide slope all the way from turning final to aerodrome threshold. No one, so far as I know, has really gone into the aerodynamic and ballistic situation existing at or near the flare-out point.

Theories do, of course, exist. For example, apart from the above "visual theory" there is the "ballistic theory," which says that it is natural for a heavy aeroplane to "keep going on down" at the flare-out point unless you ensure that the rate of sink on final approach is not greater than 600 ft. per minute; there is the "geometric theory," which says that the main gear of a modern aircraft, being well aft of the centre of rotation, prescribes an arc at the flare-out point, driving the gear into the runway; there is the "aerodynamic theory," which says that it must be expected that elevators of a modern aircraft become somewhat less efficient as a high angle of attack is assumed. But none of these theories has, so far as I know, ever been the subject of a published study; and nobody appears to have investigated how far, if at all, a general formula for "flare-out" technique might be evolved.

Boeings may, of course, have the answer in their advice on the 720: don't flare the thing at all—just allow it to settle on to the runway. They may well be right about this; but, if so, I would like to know if it can be applied to the Convair 990, to the Comet, the DC-8 and the rest. And, if not, why not? Does the 720 catch a favourable ground effect (as was reported years ago for the Victor, but of which one hears strangely little these days)? Does the 990 not catch this effect but hopes to do so with the Kreuger leading-edge flaps? These are all questions very relevant to the landing problem and as this is agreed as the cardinal problem of today's operations, we are surely entitled to some authoritative answers. Gagarin was well justified to say on landing: "I feel well; I have no injuries or bruises," but surely today's civil passenger should not even be reminded of the thought.

So until someone gives me the statistical measure of wind speed variability near the ground, the A.S.I. position error at full flap and high angles of attack, the A.S.I. system and instrumental variabilities, the true margin of the equivalent airspeed over the *one-g stall*, the temporary increase in stalling speed due to the extra loading of the round-out action and the value of ground effect from 50 ft. downwards, I will continue to believe that many of today's landing problems are due to yesterday's "mush effect."—C.C.J.

Proving the 748's Airframe

FROM Hawker Siddeley Aviation has come some information about the structural test programme that has been conducted on the Avro 748 airframe. Readers will recall that in the detail design of this new short-medium range civil turboprop transport, particular attention was paid to obtaining a fully fail-safe structure (see THE AEROPLANE AND ASTRONAUTICS for Feb. 12, 1960). The test programme intended to prove this integrity has been in progress since January, 1960.

First on the list were tests to establish the strength of the fuselage frames and floor beams when subjected to the severe loads that might be experienced in a crash landing. Later a section of the wing, including leading- and trailing-edges, was tested to demonstrate the strength of a typical wing rib both before and after the rib had been artificially damaged.

An engine sub-frame and undercarriage unit mounted on local wing structure was subjected to tests earlier this year. For this, engine and undercarriage loads representing seven design cases were applied to prove compliance with A.R.B. requirements.

While this "localized" structural testing was in progress, a fuselage complete with wings and tailplane was assembled in the static structural test frame. Tests with this airframe structure started in April, 1961, to simulate the most severe conditions encountered during the take-off, in-flight and landing regimes.

Loads were applied to the structure by hydraulic jacks using the normal system of linkages to spread the load over the whole wing to give an accurate representation of flight conditions. One of the integral fuel tanks in the wing was sealed during these tests and loads were applied with this tank full.

The landing case was the first to be investigated with this complete aircraft structure, for this controlled the design of the rear fuselage and wing rear spar. After this test was satisfactorily accomplished the principal flight loading case—a 66-ft. per sec. gust case—was dealt with. This particular case controls the design of the whole wing, in bending and of most of the front fuselage.

In the test, the loading was increased to 103% of the ultimate design load without failure.

A schedule of fatigue tests has also been in progress on the Avro 748. In August, 1960, a complete cabin structure was immersed in a new water tank at the main Avro works. This specimen was pressurized to a cabin differential of 12.1 p.s.i. During this test schedule, the fuselage withstood over 10,000 pressurization cycles.

A complete airframe has now been installed in the water test tank and will shortly be subjected to full-scale fatigue testing.

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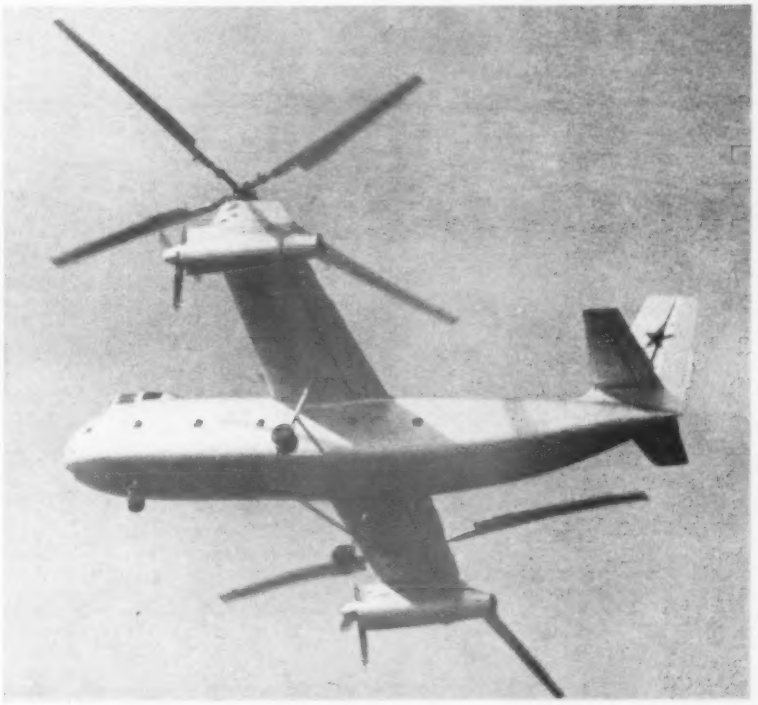

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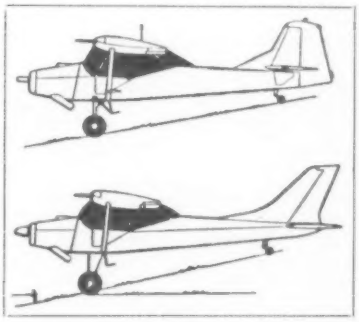

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TURBOPROP ORDER. — Caribair (Caribbean Atlantic Airlines Inc. of Puerto Rico) has ordered three Eland-powered Convair 540s for its Puerto Rico - Dominican Republic - Caribbean routes. They will seat 60 passengers each and go into service at the end of this year. Purchase price is $1 million each.

ATLANTIC TRAFFIC. — IATA carriers on the North Atlantic recorded a 5.6% increase in scheduled passenger traffic during June. Average load factors for the month fell by nearly 19 points to 53.4%, but were about 62% in the last week of June as traffic continued to climb.

CUNARD'S FREIGHT PERMIT.—The C.A.B. has transferred to Cunard Eagle the foreign air carrier permit held by Airwork, Ltd., for a North Atlantic freight service. Cunard Eagle already has an air service licence for this, but has not yet fixed a starting date. Converted Britannias may be used.

WASHINGTON JETS?—The F.A.A. recently watched tests with a United Airlines' Caravelle at Washington National Airport, which until now has been closed to jet operations. On the results of the Caravelle trials the F.A.A. will base a decision on future jet flights at the airport.

VISCOUNT CHARTERS.—Evidence of the continued World-wide demand for Viscounts is provided by news of recent inter-line charters. Lufthansa has flown Viscount services behind the Iron Curtain on charter to Tabso and Tarom. Aer Lingus has chartered Viscounts from Tradair to operate some 40 Dublin-London and Dublin-Glasgow flights between mid July and early September. An M.E.A. Viscount was chartered by Jersey Airlines for use on the Dinard, Bournemouth and Gatwick routes during July.

QANTAS TO NEW ZEALAND.—On Oct. 3, Qantas will inaugurate its first trans-Tasman services, with Electras. The service follows the sale of Qantas' 50% interest in Tasman Empire Airways, which will fly its New Zealand-Australia service in conjunction with Qantas.

ATLANTIC — NO CHANGE.—Last week's IATA working-group meeting in London to discuss North Atlantic fares (see last week's issue, p. 64) ended with the decision to make no modifications or additions to the present fare structure, which had previously been agreed for a two-year period ending on Mar. 31, 1963. The purpose of the meeting was to examine the possibility of additional promotional fares.

U.S.-U.S.S.R.—Preliminary talks were held last week in Washington concerning a Moscow-New York direct air service which was first proposed in 1958. The U.S.S.R. representatives were headed by Col. E. F. Loginov; Mr. J. M. Landis, former chairman of the C.A.B., gave the U.S. views. A P.A.A. observer attended the meeting.

DC-3 FOR NORTH-SOUTH.—The last of B.E.A.'s DC-3 (C-47) Pionairs (G-ALXK) has been sold to North-South Airlines of Leeds-Bradford Airport. It will be operated initially in the B.E.A. configuration—including the "airstair" door—but wide cargo doors (already purchased) will be installed later. The aircraft sale was handled by Travelair, Ltd.

LEBANESE CARRIER.—A new Lebanese charter operator, L.A.T. (Charter) Co. S.A.L., began operations at the end of June, using a DC-4 purchased from Jordan International Airways. The company is concentrating on charters between the Middle East and Europe.

CAMBRIAN INCREASES.—Traffic statistics for the first half of 1961 show that Cambrian Airways carried 23,141 passengers on scheduled services—an increase of 88% on the same period of 1960.

CORK OPENING.—The new airport at Cork, due to be opened earlier this year, is now expected to be ready for operations on Oct. 16, and Cambrian Airways hope then to be able to start services from London, Bristol and South Wales.

S.A.F.E. RECORD.—On Jne. 22 Straits Air Freight Express, of New Zealand, a British United subsidiary, carried 270 long tons of freight in 57 flights across Cook Strait. The previous record was 262 tons in 58 flights on May 29 this year.

BIATA MEMBERS.—Fourteen British independent airlines are now members of BIATA. The latest companies accepted for membership are Air Safaris, Ltd., Overseas Aviation (C.I.), Ltd., and Tradair, Ltd.

ARGENTINE CRASH.—A DC-6 of Aerolineas Argentinas crashed on Jly. 19 about 150 miles south-west of Buenos Aires while flying to Comodoro Rivadavia. The 60 passengers and seven crew members were killed. Reports suggest that it had been flying through a thunderstorm (and consequent heavy turbulence) at the time of the disaster.

News About People

VISITING-1.—Air Marshal Sir Kenneth Cross, A.O.C.-in-C., Bomber Command, went to the Bitteswell and Baginton factories of Armstrong Whitworth Aircraft, Ltd., on Jly. 20. At Bitteswell he was met by Mr. Eric Greenwood.

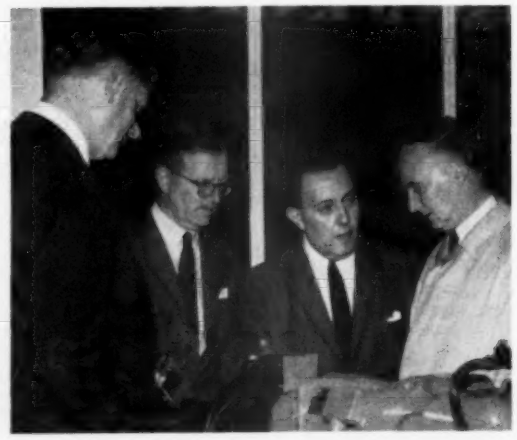
B.E.A. RE-APPOINTMENT.—Sir Arnold Overton, K.C.B., K.C.M.G., M.C., has been appointed to the Board of B.E.A. for a further period—until Jan. 8, 1963.

FIRESTONE APPOINTMENT.—Mr. A. W. Edlin has been appointed to the board of the Firestone Tyre and Rubber Co., Ltd. He has been the company's secretary since 1930.

COUNCIL MEMBER.—Among the 10 members elected to serve on the Institute of Transport Council from Oct. 1 is Mr. Gilbert H. C. Lee, B.O.A.C.'s commercial director.

VISITOR FROM MEXICO.—We learn from Duncan Y Cossio, S.A., of Mexico City, agent for a number of British manufacturers in the Mexican market, that its president, Mr. Alex Duncan, will be visiting this country during August and also will be here for the Farnborough Show. He can be contacted through the Royal Aero Club.

MR. W. HARPLEY.—It is with regret that we record the death of Mr. William Harpley, deputy general manager of English Electric Company's Preston works and the Samlesbury flight sheds, a position he held for the past two years.



VISITING-2.—Sir Steuart Crichton Mitchell, Controller of Guided Weapons and Electronics, M.o.A., (right), and Mr. J. E. Serby, Director General, Guided Weapons, M.o.A. (2nd left), discussed Short Seacat production at Belfast recently with Mr. H. G. Conway (left), and Mr. K. Teale.

Air Transport

A London Airport Authority Recommended

THE most important and significant recommendation of the report of the Estimates Committee—published last Friday—is that London's airports should be reorganized under an independent and autonomous authority. This was not an unexpected development, and the Committee makes an unusually thorough analysis of a difficult situation.

Other recommendations of the Committee include:

An immediate study should be made of the need to provide a third airport for London.

The Ministry of Aviation should specify Gatwick's rôle and produce a phased plan for its development: at least one runway should be made suitable for use by fully loaded long-haul turbojet transports.

A landing fee differential between peak and off-peak periods should be introduced at Heathrow and the 100% intercontinental-flight surcharge should be reduced.

The plan for a multi-storey car park in Heathrow's central area should be expedited.

The Committee's principal complaint about London's existing airport management is that it is inevitably hampered by civil service procedure, which is quite inappropriate for an undertaking which should be essentially commercial. The report illustrates the delaying effect of the existing planning system by explaining that major projects were held up for the Millbourn Committee's report between 1955 and 1957 and that, even after this Committee had recommended the urgent need for a new long-haul terminal, to be ready early in 1961, there had been a further six-month delay before the decision was finally taken.

The main arguments in favour of a London airport authority are that it would be able to make decisions more quickly, that it would provide a more satisfactory career structure for the staff and that it would deal in a commercial manner with an "essentially commercial situation." Such an independent and autonomous authority would be responsible for all airport technical services except divisional air traffic control.

As a proposed third airport for London, Stansted (which, in the Ministry's view, is the most promising prospect) has, the committee considered, certain serious disadvantages—notably those connected with surface communications. Even if a rail link were to be provided, major road developments would need to be undertaken. Although Stansted has a 10,000-ft. runway, this (according to a Ministry witness) is unsatisfactorily aligned in relation to the London traffic pattern. A second runway would be needed if traffic increased substantially. It is, the report considers, important that a decision, one way or another, should be reached soon—especially as large sums have already been spent on keeping this airport open. "Suspended judgment" could not be permitted to continue for long.

The report is usefully objective about the landing-fee controversy. It points out that, though Heathrow's fee for a long-haul turbojet is very much higher than Idlewild's, a number of other charges are made at the New York terminal. The total figures in a particular case (a 707 with 78 passengers on the North Atlantic service) are quoted as £361 for Heathrow (including £30 for passenger service charges) and £269 for Idlewild.

The overall cause of the difficulty over London's airports is described by the report as being the failure of the Treasury to perceive a "major deficiency" in their financial control during a period of nearly 10 years. The unsatisfactory condition of the finances of London's airports is principally the result of a failure until comparatively recently to regard them as "commercial undertakings."

"The committee . . . ," the report says, "are particularly disturbed by the fact that the serious deficiencies in the machinery of financial control escaped the attention of the Treasury for so long since . . . it is not possible to control an undertaking such as London's airports with any effectiveness without adequate financial data. . . ."

The report makes plain its belief that airport management, particularly at local level, has been conscientious and competent. The fault has lain within the system rather than with the people concerned.

On the problem of aircraft noise the Committee is impressed by the Foreign Airlines Association proposal that Heathrow's traffic should be kept flowing to the west, where there is more room for turbojets to climb before reaching a built-up area. The report recommends discussion between the Ministry of Aviation and the Air Ministry about the possibility of removing all operations from Northolt so that a suitable preferential runway system may be established at Heathrow.

The possibility that Stansted may eventually become London's third airport was mentioned in the House of Lords last week; it was described as being "the most likely candidate," but the final decision will be affected by the development, or otherwise, of supersonic transports.

The Ministry's assumption is that, with a traffic increase at the rate of 500,000 passengers per annum, Heathrow will be saturated (in terms of aircraft movements) by about 1970. The Ministry does not visualize the need for a second runway at Gatwick before 1965.

* "Fifth Report from the Estimates Committee—London's Airports"; H.M.S.O., 19s.

B.E.A. and Alitalia

THE direct association between B.E.A. and Alitalia—in which the Corporation has maintained a financial interest since the immediate post-War period—ended recently following the expiration of the 15-year agreement between B.E.A. and the Italian Government.

Following increases in capital, earlier sale of shares to B.O.A.C., and the merger in 1957 of Alitalia with L.A.I., B.E.A.'s shareholding had decreased from some 40% in 1949-50 to 6¼% in 1958-59-60.

The association between the two carriers is now limited to a commercial (pooling) arrangement for which a five year agreement was recently signed. An article on Alitalia's problems and plans appeared in our issue of Jly. 6 (p. 11).

Supersonic Feasibility

DEVELOPMENT of a Mach 3 commercial transport is feasible by 1970-71, according to a joint report issued this week by the Federal Aviation Agency, the Department of Defense and the National Aeronautics and Space Administration. The world market for such aircraft is estimated as "upwards of 200."

Because of the B-58 and B-70 bomber programmes and the earlier research and experience of supersonic flight from which they evolved, says the report, the United States has "a unique capability for developing a supersonic transport." Private industry could not alone finance the job, but will need Government assistance; some recoupment of Government funds would be possible, however, from sales of the aircraft.

The report stresses certain "basic principles" which apply to the SST project. They are that the programme is one of Government assistance to industry; that competition should be used to maximum advantage; that direct Government financial assistance should be provided only to the point from which industry can carry on alone; that the civil air carriers should participate actively; and that the maximum feasible recovery of direct Government expenditure should be sought.

Research on various parts of the problem has already been started by all three agencies, and the F.A.A. has asked Congress for $12 million in fiscal 1962 for the SST programme. The primary operational problem, according to the report, is the sonic boom.

The B.O.A.C. Appeal

SIR FRED E. PRITCHARD, a retired High Court Judge, has been appointed as the commissioner to hear the appeal by B.O.A.C. against the award of a North Atlantic route to Cunard Eagle. The A.T.L.B. announced its decision in favour of Cunard Eagle on Jne. 22 and B.O.A.C. appealed within the statutory 21 days.

The appeal is to be heard in public, at a date and place to be announced. The date is expected to be in late August or September. B.O.A.C. is expected to base its appeal on the interpretation of the Civil Aviation (Licensing) Act, 1960, and more particularly on Mr. Duncan Sandys' statement in the course of the debate on the Second Reading, when he said that the Corporations would be entitled to expect "some reasonable protection against interlopers who seek to reap where others have sown." The record of B.O.A.C.'s (not unsuccessful) struggle in recent years to achieve parity with the U.S. carriers on U.K.-U.S. routes will be produced, and the point will be pressed that Cunard Eagle would be benefiting from this development.

Air Transport . . . .

K.L.M. Talks Fail

AFTER nine weeks of negotiation in Washington, the U.S. and Dutch delegations have failed to reach agreement on a revision of the bilateral air agreement between the two countries. K.L.M. has for long wanted to serve the U.S. West Coast, and the present series of talks was held at the instigation of President Kennedy, who apparently was eager to concede the Dutch request. The U.S. has continued to insist, however, that, in return for a West Coast route, future increases of capacity on the existing K.L.M. North Atlantic routes should be restricted. This point K.L.M. refused to concede.

After the talks had ended, Mr. E. G. Stijkel, Dutch Minister of Transport, made the following statement:—

"There was a big difference between the American and Dutch interpretation of the Bermuda agreement. Last night the American delegation outlined its final position after President Kennedy personally informed himself about the state of affairs. Mr. Kennedy had authorized the final American offer which, however, asked for concessions we are not prepared to give.

"The American offer was discriminatory and a cause for bitter disappointment. As long as the United States maintains its present aviation policy I see no possibility. There are, however, some grounds for hoping the policy will be revised. After all, seven other nations tried to get landing-rights in the United States this year, and failed like we did."

Northeast Merger Prospects

EASTERN AIR LINES' interest in a merger with Northeast Airlines appears to be hardening. As we noted last week ("Reducing the Competition," page 64), the C.A.B. is actively investigating the prospects for the merging of Northeast with a stronger trunkline, and is using the Northeast application for a renewal of its New York-Florida route licence as a catalyst. Eight airlines have shown tentative interest in such a merger, but at least four—Pan American, T.W.A., Riddle and Trans Caribbean—are unlikely to meet with the C.A.B.'s approval.

Of the other four airlines interested—Eastern, National, Delta and Northwest—Eastern is regarded as the C.A.B.'s favourite, and, at a pre-hearing conference with the C.A.B. recently, showed more positive signs of interest than any of the others. For the airline, a spokesman said that "sound programmes for the integration of the routes of Northeast with another carrier or carriers can be formulated pursuant to reasonable terms and conditions." Eastern "will bend its efforts to assist" the C.A.B. in achieving a merger.

The Battle of Statistics

FOR three days last week, the Air Transport Licensing Board plodded steadily on with the series of individual applications for European routes from the independent companies. The hearings followed the pattern described in our previous issue and B.E.A., as the principal objector, continued to snipe away at the independents' case. Most of B.E.A.'s efforts were devoted to establishing (1) that none of the independents would succeed in creating any new categories of traffic and (2) that any traffic carried by the independents would of necessity be diverted wholly from B.E.A. by reason of the bilaterals.

This is not to say that B.E.A. always had a watertight case. There were times last week, for instance, when Mr. Gerald Gardiner, Q.C., for B.U.A., was able to make nonsense of the Corporation's own statistics, which were shown to contain errors and anomalies.

Among points of interest which arose during the week was the plan of Silver City Airways to use a public street in Madeira as a landing strip for Caribou aircraft, which would link with a Gatwick service at Funchal. For its service to Genoa, if approved, Silver City would use Viscounts; this route had been developed by the company with flying-boats and Silver City believed it should be allowed to "reap where it had sown."

B.E.A. was developing the Vanguard to seat 150 passengers in future high density versions, and needed more traffic for these aircraft. The Dublin service, on which lower fares were to be introduced in conjunction with Aer Lingus, was one where the Vanguard could be used "fully and economically." The new fares would be "comparable with those on the B.E.A. domestic trunk routes" and were designed to "take a far higher share of business away from surface transport than B.E.A. has ever succeeded in doing in the past."

Falcon Airways' Problems

MUCH publicity in the national Press attended Falcon Airways difficulties, over the week-end of Jly. 15/16, in meeting its commitments to fly inclusive tour passengers from Gatwick. The fact that some passengers were delayed more than 24 hours was attributed by the company to the refusal of the Ministry of Aviation to allow it to charter an aircraft from Austria.

On Jly. 19, the Ministry took the unusual course of issuing the following detailed statement on the situation:—

"Falcon Airways Limited yesterday made a further request to the Ministry for permission under Article 68 of the Air Navigation Order, 1960, to use an Austrian registered Constellation aircraft, OE-IFA, for flights from Gatwick for inclusive tours during the coming week-end [i.e., Jly. 22/23]. The Ministry received a similar request for the use of OE-IFA on Friday last, 14th July, for flights from Gatwick last week-end.

"Falcon Airways have no aircraft available. Their Constellation G-AMUP is undergoing modification for the installation of fire protection in accordance with the Air Registration Board's requirements first notified to them in January, 1961. Their Constellation G-AHEL was transferred on 13th July to Trans-European Airways Limited. Their Constellation G-AHEJ has no Certificate of Airworthiness.

"According to information from the Austrian authorities the aircraft OE-IFA for which permission was sought had been placed on the Austrian register on the 27th June, Aero Transport Flugbetriebsgesellschaft being the registered operator. It had been supplied by Captain Kozubski, the Managing Director of Falcon Airways, who were registered as the owners. It is understood from the Austrian authorities that Captain Kozubski would pilot the aircraft.

"Under the Air Navigation Order, 1960, there is discretion to grant or refuse permission for foreign registered aircaft to pick up or set down passengers for hire or reward in this country. In the exercise of this discretion, the Ministry has formed the view that the connection between Falcon Airways, Captain Kozubski, and the operation of this aircraft were so close that the permission ought to be withheld on the ground that the use of this aircraft in these circumstances would enable it to be flown virtually by a British undertaking, and carrying British passengers, without regard to many of the safety requirements of the Air Navigation Order, 1960, and particularly the safety conditions attached to the Air Operator's Certificate held by Falcon Airways. Falcon Airways have been so informed.

"Falcon Airways hold an Air Operator's Certificate limiting their operations to an area covering broadly Europe and the Mediterranean and if they complied with the conditions of their certificate and the requirements of the Air Navigation Order and Regulations there would be no objection to their carrying out these flights with British-registered aircraft. The flight time limitations of the Order governing pilots' hours are particularly important."

Mr. F. Beezley, a director of Falcon Airways, said of this statement that he "strongly repudiated the implication . . . that there was any attempt to fly the aircraft . . . without proper regard to safety standards." It was, he said, "neither decent nor accurate to imply that the standards set by or permitted by the Austrian Ministry are lower than those set by the Ministry of Aviation in England." Neither Capt. Kozubski nor Falcon Airways, Ltd., hold any shares or debentures in Aero Transport, the registered operators of the Constellation in question.

WALL STREET HELIPORT.—Despite its convenient location in downtown Manhattan, well shown in this picture, the Wall St. Heliport does not at present produce a large amount of traffic, and is used by New York Airways only as a flag-stop on flights to and from the New York airports.

INTO SQUADRON SERVICE

This new addition to the strength of the Royal Navy is the turbine powered Westland Wessex helicopter which is now entering squadron service with the Fleet.

Capable of carrying both detection equipment and offensive armament this aircraft is one of the few helicopters able to handle both the search and strike phases of anti-submarine defence, and modern automatic equipment enables the machine to operate by day or night in all weathers from either ship or shore bases.

As a transport machine it will carry 16 fully armed troops and be capable of placing a striking force direct from a carrier to the centre of operations in a minimum of time.

This helicopter type has completed an intensive flying programme under all conditions prior to going into Squadron Service.

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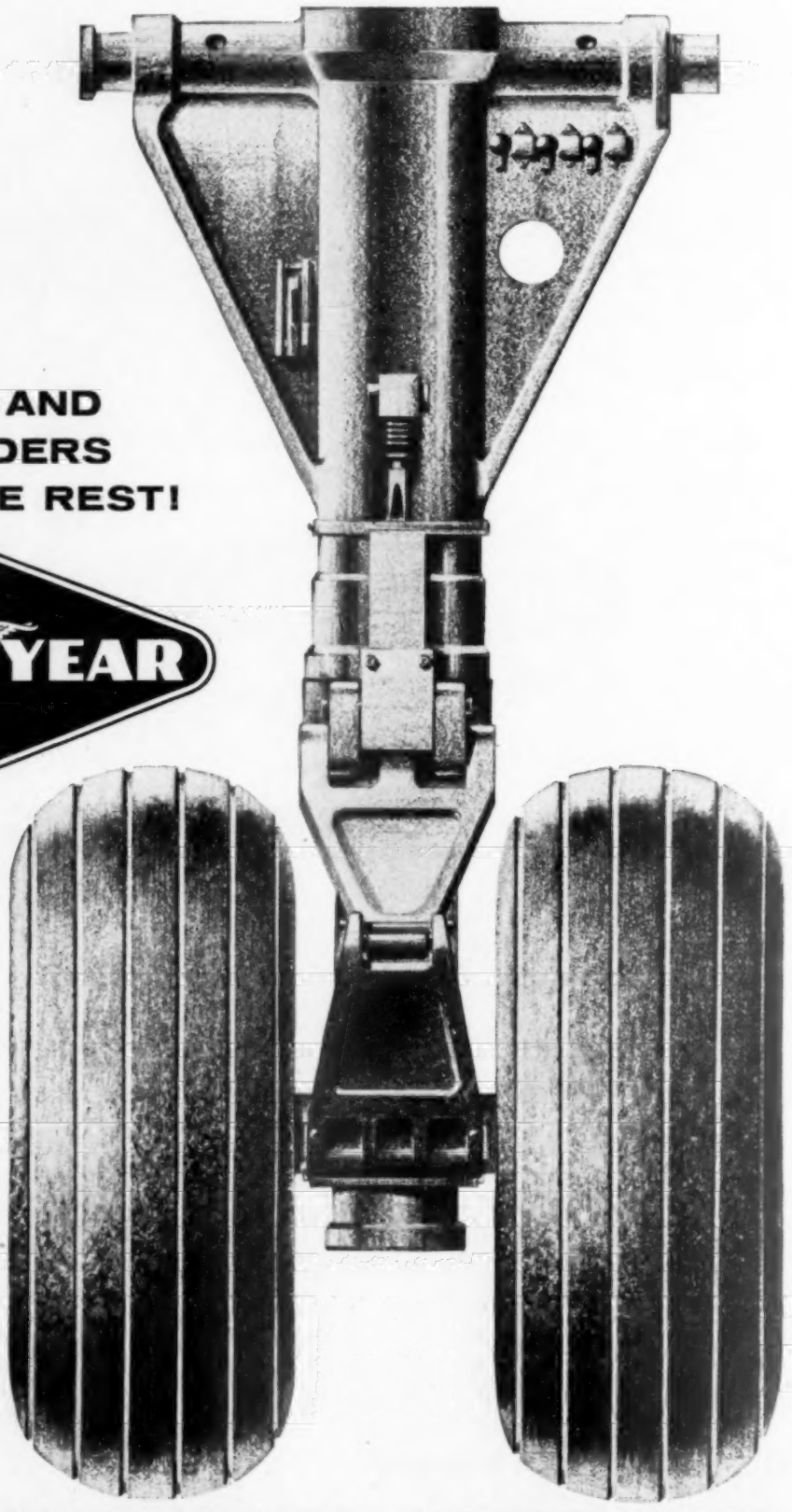

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Air Transport . . . .

Back to Turnhouse

ON Aug. 1 Edinburgh's Turnhouse Airport will be reopened for scheduled operations. It has been closed since Apr. 5 for runway, apron and taxiway work, and services have been operated temporarily through East Fortune.

Work has included the strengthening of the main 6,000 ft. 13/31 runway, the level of which has been raised by about five inches; the installation of centre-line and new threshold bar lighting, of visual glide-path indicators and of a new instrument landing system with glide path; the laying down of a new taxiway and extended apron; and the construction of a new Customs block.

This building will not, in fact, be completed in time for the opening, but, with the terminal building alterations, it will, in due course, almost double the accommodation for passengers at Turnhouse. Work is due to start next month on the erection of a "Dorval-type" control room on top of the existing tower; this "glass house" will improve the field of vision for the air traffic controllers. The total cost of the alterations at Turnhouse will be about £200,000.

Air Congo Created

WITH technical and operational assistance from Sabena, Air Congo has been set up as the "chosen instrument" airline of the Congo Republic for domestic and international operations. Its headquarters are in Leopoldville and the senior executives are M. Hubert Sangara, president of the Council of Administration, M. Gilbert Périer, vice-president, and M. Fernand Essandja, general manager.

Initial capital of the company is 200 million Congo francs, of which the Congo Government has subscribed 65%, Sabena 30%, and Sobelair and Air Brousse jointly 5%. Aircraft previously used by Sabena in the Congo, including DC-4s, DC-3s and Convairliners, have been operating in Air Congo colours for several months.

Air Ceylon's Future

A THREE-MAN Ministerial committee of inquiry has been set up to investigate the future of Air Ceylon and its international and domestic services. This was announced by the Minister of Transport, Mr. P. G. B. Kalugalle, following K.L.M.'s recent request that Ceylon should in future bear a larger share of losses on international services. K.L.M. entered into an operating agreement with Air Ceylon five years ago under which it provides aircraft and personnel for the services to London and Singapore.

K.L.M. is said to be prepared to continue its association with Air Ceylon only if future losses are shared. The losses over the past five years have amounted to "millions of rupees." Air Ceylon has been passing through a difficult time of late, and allegations of mismanagement and nepotism have been made.

The general manager, Mr. J. L. M. Fernando, was replaced a year ago by Mr. W. A. E. Molamure, who said recently that there was no money available for future development because of mistakes in the past. This was challenged by Mr. Fernando, who said that the company had become profitable during his time as general manager.

Latest figures for Air Ceylon operations are for the year ended March, 1959, and show a profit of Rs.189,960. This was the fifth successive year in which a profit had been made. Air Ceylon's position has been made more difficult in recent weeks by T.W.A.'s decision (THE AEROPLANE AND ASTRONAUTICS for Jly. 6) to abandon its service to Colombo after Aug. 1. The loss to Air Ceylon is estimated at Rs.40,000 in commission on the sale of tickets and handling charges.

IATA on Noise

DESCRIBED as a "general prescription for the best methods of abating noise in jet aircraft operations," a document on noise abatement drafted by an IATA study group is being given World-wide circulation. Its general theme is that noise control is best achieved by proper flight path selection and that quantitative measurements of noise levels at particular points are not practicable or desirable.

For a given take-off weight, the most significant reduction in noise comes from getting the aircraft as high as possible before reaching the noise critical area, says the report, followed by the maximum practical reduction in engine power whilst over-flying the area. National administrations should specify their rules in terms of flight procedures to be developed in agreement with the operators concerned.

The IATA Noise Abatement Study Group responsible for this report, is under the chairmanship of Captain A. P. W. Cane of B.O.A.C. Its secretary is Mr. J. L. Gilmore, of the IATA Technical Liaison Office in London. Extracts from the report's recommendations follow:

Administrations concerned with noise problems should designate potential noise areas related to approach and take-off paths in the vicinity of airports where air/ground noise, even when carrying out minimum noise techniques, would be higher than the normal acceptable limits and potential local residents should be so advised. They should also request local authorities to take into account this fact in building or development programmes.

To reduce noise during climb-out after take-off, aircraft should climb at the maximum gradient consistent with safety under prevailing conditions until approaching a predetermined critical area. At that point, provided the aircraft has attained a minimum ground clearance of 600 ft., power should be reduced to the minimum required to give the best safe rate of climb consistent with terrain clearance and noise considerations applicable to all communities in the environs of the airport. This climb should be maintained until at least 1,500 ft.; and normal climb power should not be re-applied below 2,000 ft. or until past inhabited areas. However, noise abatement procedures should not be applied above 3,000 ft.

The use of preferential runways for take-off is acceptable only as a noise-abatement measure, because in normal operations they complicate A.T.C. procedures and present the pilot with undesirable limiting conditions on take-off. Preferential runway use for take-offs should normally be limited to conditions of a 5-knot tail wind component and a 15-knot cross wind component on a dry runway, provided these do not require a reduction in gross weight

L. A. INTERNATIONAL.—Likely to become one of the best-known of airport landmarks anywhere in the World, the so-called Theme Structure at Los Angeles is seen nearing completion below. The first of the satellite buildings at the new terminal (United's No. 7), and the 172 ft. administration building and control tower (below right) were recently dedicated.

Air Transport . . . .

below that required for the specific flight; and should not impose abnormal take-off delays. Any system of using preferential runways shall be equally applicable both by day and night.

Weight restrictions to meet noise requirements at a specific location or altitude impose penalties on operators and the travelling public out of all proportion to the advantages gained in noise reduction. To be effective, the required reduction in gross weight in many cases renders economic operation impracticable: for example, in the case of one jet airliner used in current operations, a 60-80% reduction in payload is necessary to obtain a reduction of only one decibel.

Lower U.K.-Ireland Fares

AER LINGUS and B.E.A. are planning to reduce the fares between Britain and Ireland by a substantial amount as from April next year. At a recent A.T.L.B. meeting a B.E.A. representative said that the reductions planned by the Corporation would make the new rates comparable with those applying to its domestic routes, and the words "reduce substantially" have been used by an Aer Lingus representative. Discussions between the carriers were continuing last week over the question of the way in which the reductions will be applied.

Special attention is being paid by Aer Lingus to the business of looking after the travelling public. A "customer relations board" has been set up; this is responsible for the personal sampling, by selected executives, of service to the customers throughout the Aer Lingus network. Additionally, a permanent committee of senior executives is studying passenger and baggage arrangements at airports.

The appointment of a general manager for Britain, Mr. Geoffrey W. Pitt, is also designed to give better customer service by decentralization; all district officers in England, Scotland and Wales now report to Mr. Pitt and not to Dublin.

These points were among those made by Mr. M. J. Dargan, assistant general manager (commercial), at a party last week to celebrate Irish International Airlines' 25th anniversary and to introduce Mr. Pitt.

The Vanishing Crews

AIRCREW utilization is vital to the economy of an airline. A sample of airline crew statistics shows that the domination of the pilot has extended to such a state that the economics of operation measured in flying hours and utilization has become unstable. Is the best use made of fully qualified aircrew or has this present trend brought to an end the day of the specialist navigator and radio operator?

Consider the figures in the table below. The rise in pilot strength as against other aircrew has been phenomenal. Is this is a good thing for aviation?

Civil legislation lays down the requirements regarding the licences to be held by the various operating crew members. The maximum duty and flying times are also laid down (these do not always agree with the airline minima which in most cases are much more generous). There would therefore appear at first glance to be little reason for the excess of pilots in the cockpit, particularly if there are available flight navigators and radio operators and engineers who can fulfil the balance of statutory duties. So is this present trend the best path to take, both operationally and economically?

Take the pilots' case. The tempo of operation has increased rapidly with the advent of the jet—but on the long-haul intercontinental runs this increased activity is limited to the take-off, climb, descent and landing. The essence of pilot strain in regard to jet flying is a heavier workload and greater responsibility, allied to more rapid and greater changes in climatic conditions and to rapid changes in meal and rest times.

Aircrew fatigue is directly allied to the effect of the length of the duty day and flying time, the number of landings and take-offs during a duty period, the weather, the type of aircraft, the crew carried and the ground aids available on the sectors flown. Yet ICAO and R.A.F. tests have shown that it is not at present possible to arrive at any objective assessment as to what constitutes flight fatigue. Granted that there is this fatigue, what steps can be taken to alleviate it?

The pilot answer is to recruit two additional pilots to the crew. They have asked for a "meal" pilot to be carried who can take over from the Captain or First Officer as a relief during meals or rest periods. Secondly, they have suggested that an Aircraft Commander should "oversee" the work of the Captain and First Officer. The first suggestion on a long flight is a proper one. The question of the Commander is more difficult, and has met with opposition from many sides. There is no legal requirement for the Commander of an aircraft to be a pilot (or even qualified in any particular field) and in any case the presence of three specialists could lead to a difference of opinions which could be disastrous.

AIRLINE	Crew	1946	1950	1955	1961
B.E.A.	Pilots ..	—	376	595	755
	Navs. ..	—	Nil	Nil	Nil
	R/Os. ..	—	196	207	120
B.O.A.C.	Pilots ..	573	555	690	1,007
	Navs. ..	201	191	144	182
	R/Os. ..	293	241	257	Nil
TRANS-CANADA AIRLINES	Pilots ..	334	288	524	776
	Navs. ..	12	18	20	22
	R/Os. ..	10	18	Nil	Nil
TRANS WORLD AIRLINES	Pilots ..	700	846	1,322	1,415
	Navs. ..	200	82	88	73
	R/Os. ..	150	121	101	Nil

The navigator strength has remained roughly constant whilst the pilot increase in most airlines has been about 100%. The airline attitude to the employment of the flight navigator is a peculiar one. No one denies that they are needed, or questions their qualifications, but the airlines have succumbed to the use of the pilot-navigator.

The history of aviation has shown that the navigator is a far different breed from the pilot. He lacks the glamour—he is the steady against the dashing. The onus of a successful long-distance flight is on the navigator and the employment of a specialist navigator removes a great deal of the strain from the pilot. Good pilots are as rare as good navigators—but good pilot-navigators are very rare indeed. In general the presence of pilot and navigator should form the basis of a team—the niceties of each profession being practised by specialists in their own field, and a balanced judgment being provided. In the case of the "team" becoming one man there must inevitably be a conflict of judgment which will in itself create an unnecessary mental strain.

Finally, the radio operator—poor chap! Look at the figures—what a tumble he has taken. Of course progress and R/T have been the victors—the provision of reliable VHF R/T and self-contained fixing aids have to a great extent done away with his job for ever. But should his experience be thrown overboard?

I feel the airlines can blame themselves for being manœuvred into a position where economic crew utilization is far from an achievable fact. The use of pilots as navigators is not an economic one. Legislation lays down that a flight navigator (whose only duty is navigation) must be carried on all flights of over 1,000 nautical miles over water or 1,500 n.m. non-stop over land. Yet, for example, T.W.A. operate 40 weekly Boeing 707 flights eastbound from America alone and their navigator strength has fallen from 200 in 1946 to 73 at the present time. B.O.A.C. have the same number of navigators as they had 15 years ago yet their pilot strength has increased by 85% in the same period. In every case the inter-continental route mileage flown has increased enormously. No wonder there is a pilot shortage!

Surely there is a potential supply of experienced navigators and radio operators sufficient to form the basis of "old look" crews. Why should the R/O not handle the entire communication side of the aircraft, the storm approach radar, Doppler and so on? The navigator can then be responsible for the navigation, airways clearance, position reports, etc., leaving the Captain free to fly the aircraft. By such a division of responsibility a more single-minded approach can be made to the problems of the flight. If it is necessary to relieve either Captain or First Officer it can be done by the Commander (if he has to be a pilot) who can also act as meal pilot relief. In this way, there appears to be no reason why the flight deck crew should exceed five in number, of whom three would be pilots.

The present trend in the use of the pilot is unsatisfactory in so far as it creates a diversion of interest. Basically a pilot wants to fly the aircraft and his other employment does not satisfy him. In addition he becomes Jack of two trades—and most probably master of none!—ROBERT LENZIE.

The C.F.S. Today

by Wren

THE EXECUTIVE.—Above, Air Cdre. H. P. Connolly, Commandant, Wg. Cdr. C. K. Gray, Unit Commander and Gp. Capt. R. P. de Burgh, Chief Instructor.

THE unveiling of the Trenchard Memorial (recorded elsewhere in this issue) a few days after the Central Flying School Association held their 1961 annual reunion dinner offers fair reason for a brief look, in word and picture, at the World's oldest flying school, which was one of the great "Boom's" especial interests from the time he passed the first course in 1912.

Under its present Commandant, Air Cdre. H. P. Connolly, D.F.C., A.F.C., D.F.M., today's C.F.S. enthusiastically applies itself to maintaining the highest possible standards of flying instruction. It produces Qualified Flying Instructors for the R.A.F., the R.N., the Army and the Services of many other countries.

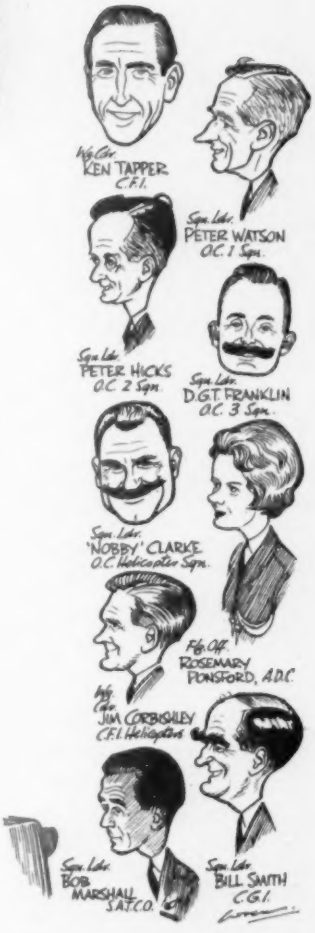
The School's work might be grouped this way: 1. **The Production Line**—producing Q.F.I.s, that is. 2. **After-sales Service**—standardizing techniques and instructional ability, often by visits to schools here and abroad. 3. **Research**—investigating flying and handling techniques and special flying training tasks.

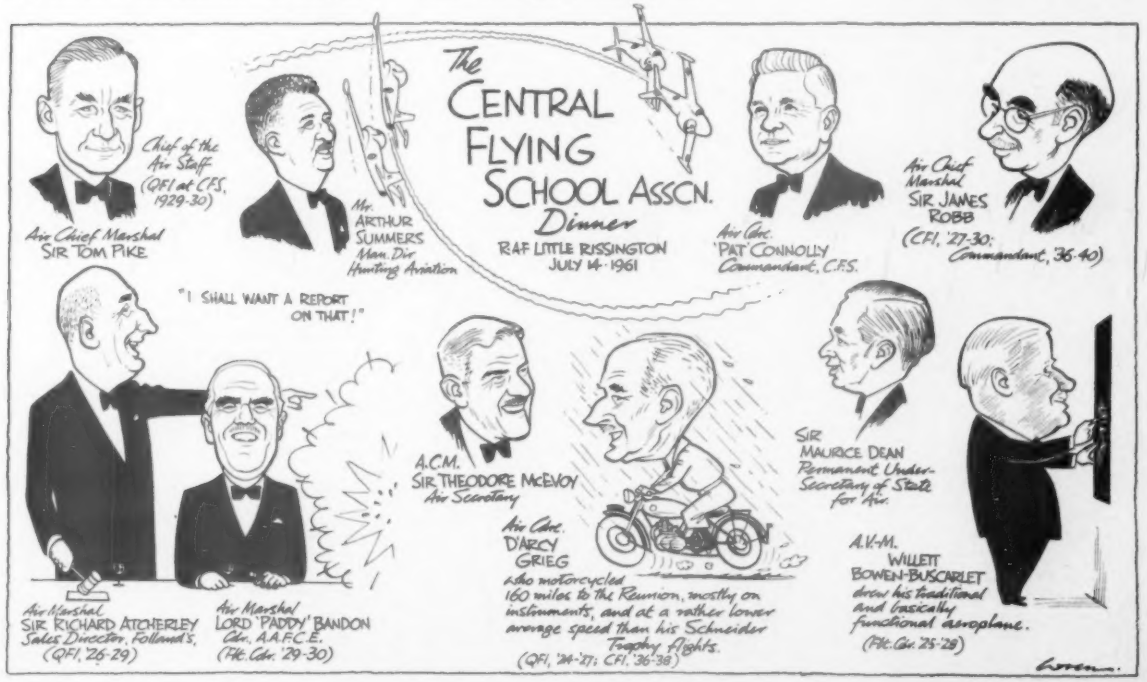
Pupils arrive as experienced pilots from all Commands with at least one tour to their credit. They spend the first half of the 19-week course on the C.F.S. No. 1 (Basic) Squadron's Jet Provosts, then split to various advanced and applied rôles, either to the School's No. 2 Squadron, for those going to Jet Provost, Vampire or Meteor schools, or to the No. 3 Squadron for those going to Varsity schools. Types of aircraft at C.F.S. are: Chipmunk, Provost, Jet Provost, Vampire, Meteor, Anson, Varsity, Canberra and Hunter; and Dragonfly, Skeeter, Sycamore and Whirlwind helicopters.

The Standards Sections (the old Examining Wing or "Trappers Union") provides the "After-sales Service." C.F.S. Instructors, visit schools and fly with a cross-section of instructors and pupils to ensure that training is following C.F.S. standards and that the quality of the flying is right; they visit operational squadrons, by invitation from Commands, and Operational Conversion Units, to see if Flying Training Command standards are meeting those of the customers, the operational Commands. The Section also deals with instrument rating examiners' awards and qualifications and instructor re-categorization tests.

C.F.S. representatives frequently visit overseas Commands and, by invitation, other countries' Air Forces. Air Cdre. Connolly is soon to set off with two instructors in a Canberra on a tour of the Far East, Pakistan and Ceylon. Wg. Cdr. Ken Tapper, C.F.I., recently returned from a liaison visit to the R.C.A.F.'s C.F.S.

Looking to the future, the school has a Q.F.I. at Follands, in preparation for developing a syllabus for the integration of the Gnat Trainer with the Jet Provost. And the School is developing a "Multi-stream" plan to assist it to decide, at an earlier stage, the pupil's suitability for a certain category of aircraft—i.e. fighter, bomber, etc.


Wg Cdr KEN TAPPER C.F.I.
Sqn Ldr PETER WATSON O.C. 1 Sqn.
Sqn Ldr PETER HICKS O.C. 2 Sqn.
Sqn Ldr D.G.T. FRANKLIN O.C. 3 Sqn.
Sqn Ldr 'NOBBY' CLARKE O.C. Helicopter Sqn.
Flt Off ROSEMARY PONSFORD, A.D.C.
Wg Cdr JIM CORBISHLEY C.F.I. Helicopters
Sqn Ldr BOB MARSHALL S.A.T.C.O.
Sqn Ldr BILL SMITH C.G.I.


The CENTRAL FLYING SCHOOL ASSCN. Dinner
R.A.F. LITTLE RISSINGTON JULY 14·1961
Chief of the Air Staff (QFI at C.F.S. 1929-30)
Air Chief Marshal SIR TOM PIKE
Mr. ARTHUR SUMMERS Man. Dir. Hunting Aviation
Air Cdre. 'PAT' CONNOLLY Commandant, C.F.S.
Air Chief Marshal SIR JAMES ROBB (C.F.I. '27-30; Commandant, '36-40)
"I SHALL WANT A REPORT ON THAT!"
Air Marshal SIR RICHARD ATCHERLEY Sales Director, Follands, (QFI, '26-29)
Air Marshal LORD 'PADDY' BANDON Cdr. A.A.F.C.E. (Flt. Cdr. '29-30)
A.C.M. SIR THEODORE McEVOY Air Secretary
Air Cdre. D'ARCY GRIEG also motorcycled 160 miles to the Reunion, mostly on instruments, and at a rather lower average speed than his Schneider Trophy flights. (QFI, '24-'27; C.F.I. '36-'38)
SIR MAURICE DEAN Permanent Under-Secretary of State for Air.
A.V-M. WILLETT BOWEN-BUSCARLET drew his traditional and basically functional aeroplane. (Flt. Cdr. '25-'28)

The Fighting Services

Flying Training Appointment

REAR ADMIRAL P. D. GICK, O.B.E., D.S.C., R.N., is to succeed Rear Admiral F. H. E. Hopkins, C.B., D.S.O., D.S.C., R.N., as Flag Officer, Flying Training, in October.

Joining the Royal Navy as a special-entry cadet in 1931, Rear Admiral Gick volunteered for flying as a Sub Lieutenant in 1936. He took part in the attack on the "Bismarck" by No. 825 Squadron from H.M.S. "Victorious," and from December, 1941, to September, 1942, commanded No. 815 Squadron in the Western Desert. After service in the Admiralty he became Lieutenant Commander (Flying) in H.M.S. "Vindex," the first night anti-submarine carrier.

Naval Assistant to the Second Sea Lord from 1950 to 1952, he assumed command of R.N.A.S. Lossiemouth in 1954. Three years later he took over command of the former aircraft carrier "Bulwark" now used as a Commando carrier.

Royal Visit to Swanton Morley

TODAY His Royal Highness the Duke of Gloucester is planning to visit the R.A.F. Central Servicing Development Establishment at Swanton Morley. He will be met by the A.O.C.-in-C., Maintenance Command, Air Marshal Sir Leslie Dalton-Morris. The Air Member for Personnel, Air Marshal Sir Arthur McDonald; the Air Officer Commanding the group of units which include Swanton Morley, Air Vice-Marshal D. W. R. Ryley; and the O.C., Swanton Morley, Gp. Capt. R. E. W. Harland, will also be present.

The Duke will arrive by air at 11.00 hrs. and, after inspecting the guard of honour, will move to a display centre, tour the education centre and see an exhibition of hobbies. After lunch a tour will be made of the printing section and various testing bays, followed by visits to the Cambridge University Air Squadron—on summer camp detachment at the airfield; No. 1249 (East Dereham) Squadron, A.T.C.; No. 611 Gliding School, A.T.C.; and No. 6219 Bomb Disposal Flight.

The primary object of the Central Servicing Development Establishment is to foresee and plan in the field of servicing the varied technical equipment used by the Service, with a view to minimizing the work, and generally reducing maintenance costs.

Last Operational Meteors

FOR the past months No. 60 Squadron (Wg. Cdr. P. Smith, M.B.E.) and No. 81 Squadron (Sqn. Ldr. S. J. West) at R.A.F. Tengah, Singapore, have had a competition for the honour of giving the positively last farewell to the Meteor as an operational aircraft. But with the recent transfer of No. 81 Squadron's two remaining Meteor PR.10s to R.A.F. Seletar for disposal, No. 60 Squadron, still operating some Meteor NF.14s, has won this honour.

No. 81 Squadron is continuing its present rôle with Canberra PR.7s and No. 60 Squadron will dispose of its last NF.14 when it is fully re-equipped with Javelin FAW.9s. As we recorded recently, No. 60 is the first squadron to operate in the night all-weather fighter rôle in the Far East and has been equipped with tropicalized Meteor NF.14s for approximately 18 months. The first of its 16 Javelins arrived at Tengah in April.

The two No. 81 Squadron Meteors were flown to Seletar by Flt. Lt. B. Ashley (who had taken part in the Squadron's last "Firedog" operation only 10 days before) and Flt. Lt. R. Littlejohn.

Easier Technical Promotion

AN experiment in up-grading R.A.F. technical standards in the Mediterranean and Middle East areas has just completed its first year. It followed the formation of the Near East Air Force Travelling Trade Test Board—whose 12 members have now travelled a total of 500,000 miles in 12 months, testing more than 1,000 candidates.

One of the main N.E.A.F. objects in establishing the Board was to prevent varying standards occurring in its technical trades and to make tests comparable with those in the United Kingdom. In the past, the majority of overseas stations tested their own candidates, which resulted in wide differences in quality of the newly promoted airmen.

In some ways the Board has the advantage over trade schools in the U.K. because, generally, its tests must of necessity be more practical. At home, the tests are usually conducted under training conditions with mock-ups and models of aircraft and parts. In the Near and Middle East Commands they are mostly on operational aircraft, which have to be cleared and flight-tested immediately following the candidate's examination.

The start of the new scheme coincided with the introduction into the R.A.F. of "bonus" trade pay, which results in a flood of candidates for trade testing.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. P. D. P. Stevens, to the Department of the Chief of the Air Staff; Gp. Capt. E. L. Frith and Wg. Cdr. F. Mandeville, to the Department of the Air Member for Personnel; Gp. Capt. R. R. Goodbody, O.B.E., and Wg. Cdr. R. Storey to the Department of the Air Member for Supply and Organization.

Bomber Command: Wg. Cdr. L. Preddy, A.F.C., for air staff duties, and Wg. Cdr. N. G. O'Brien, M.B.E., for technical staff duties, to Headquarters.

Fighter Command: Wg. Cdr. D. E. Gibbs, M.B.E., to R.A.F. Waterbeach as Senior Technical Officer.

Coastal Command: Wg. Cdr. J. V. Marshall, D.F.C., to Headquarters for air staff duties.

Transport Command: Wg. Cdr. H. J. Dodson, A.F.C., to Headquarters as Group Captain Plans, with the acting rank of Gp. Capt.; Wg. Cdr. E. J. Watts, M.B.E., to R.A.F. Dishforth as Senior Technical Officer with No. 242 Operational Conversion Unit.

Maintenance Command: Sqn. Ldr. D. K. Kempston to R.A.F. Bicester to command No. 71 Maintenance Unit, with the acting rank of Wg. Cdr.

Air Forces Middle East: Sqn. Ldr. W. A. J. Iles to R.A.F. Khormaksar, as Senior Equipment Officer, with the acting rank of Wg. Cdr.

Far East Air Force: Gp. Capt. T. R. Pierce to R.A.F. Tengah to command; Wg. Cdr. I. J. Davies, M.B.E., to Headquarters for equipment staff duties.

WATTISHAM TYPES.—A mixed all-weather pair from R.A.F. Wattisham comprising a Lightning F.1A of No. 56 Squadron (Sqn. Ldr. J. R. Rogers) and a Javelin FAW.8 of No. 41 Squadron (Wg. Cdr. D. W. H. Smith). No. 56 was the second Fighter Command squadron to re-equip with the Lightning.

Napier's Agri-copter

THE BENSEN range of "gyro-copters," or rotary-wing kites, towed by surface or water transport, or fitted with their own engines for propulsion, are well known throughout the World from the plans and kits of parts which have been offered for amateur construction. Many hundreds have been built from the 100,000 sets of plans sold, and have flown with varying degrees of success in the hands of enthusiasts.

In the U.K., a close study of these interesting and original designs has aroused interest in their more serious potential, and the first commercial adaptation of a Bensen Gyro-Copter was shown by D. Napier and Son, Ltd., at Luton last week. Derived from the single-seat Bensen Model B8-MEJ machine, the Napier Agri-copter is intended as a simple and economical crop-spraying vehicle for small-acreage farming, and has been developed in conjunction with Pan Britannica Industries, the aerial spraying contractors.

Collaboration between the two companies began some two years ago to find the ideal agricultural aircraft. Requirements for this type were laid down at the 1959 Cranfield conference and envisaged the ultimate use of radio-controlled aircraft. Napiers chose the autogyro as the best combination of the virtues of both rotary- and fixed-wing aircraft, for low-speed performance and handling coupled with simplicity and minimum costs, as the basis of development.

The Bensen B8-MEJ was bought in kit form, and built by Napiers for preliminary trials. It has since been developed and fitted with the basic agricultural equipment, and a further year or 18 months' evaluation and study is envisaged before possible production. This will initially be by Napiers at Luton, and of the manned version—although the company holds patents on the radio control of agricultural aircraft.

The Agri-copter is intended mainly for spraying conditions in Britain, where the average field length (10-acre area) is 220 yd. Using light aircraft, it takes 10 sec. to lay a swath down the field, and 30 sec. to turn at each end for the return run. With the low-speed manœuvrability of the Agri-copter, turning time should be reduced by half, with a corresponding increase in productive flying. Another advantage is that the performance and handling qualities of the Agri-copter permit much lower and more rapid approaches to confined fields, and it is possible to operate between 8 in. and 1½ ft. above the crop.

This was demonstrated at Luton in comparative runs flown by the prototype Agri-copter, G-29-3—piloted by Mr. S. J. Bartlam, a Napier test pilot—and a Tiger Moth. The Agri-copter was able to hug the ground, hopping over hedges and fences, and turning rapidly at slow airspeeds in a manner quite outside the scope of the Tiger Moth. The take-off and landing runs were also much shorter, required field lengths being about 150 yd., with reasonable approaches.

The essential mechanisms of the Napier Agri-copter; the wheel above the propeller hub is the principal drive for rotor spin-up.

Photographs copyright "The Aeroplane and Astronautics"

A lively performance by the Agri-copter in the air is characterized by the steep-angle take-off being demonstrated in the lower photograph.

Landing run of the Agri-copter is very short, the take-off having been limited by the necessity to attain sufficient rotor revs. through forward speed, in the absence of a strong wind. The rotor, of course, free-wheels at all times in an autogyro, but the attainment of take-off r.p.m. has been solved in the Napier design by the addition of a spin-up system, driven from the 68-b.h.p. McCulloch two-stroke four-cylinder engine.

By pulling down a hand lever below the rotor head, the pilot brings into mesh a Bendix starter-type gear, which is rotated by a flexible drive from a contact-driven wheel operating behind the airscrew hub. The twist-grip throttle forming the top of the control column is opened to accelerate the rotor, which is pre-spun to 300 r.p.m. for take-off, varying between 375-390 in flight. The spin-up gear adds about 18 lb. to the weight.

At the moment, a 6-gal. agricultural payload is carried in a tank which forms the pilot's seat back. It is hoped to increase the payload to 10 gal. after fitting a larger-diameter rotor and an improved propeller. A 10-gal. capacity is sufficient to spray two acres for most applications, and should permit a coverage of 40 acres/hr. It is hoped to reduce the costs per acre by about half compared with fixed-wing aircraft, and by about two-thirds for helicopters, to about £11-£12 an hour. Initial cost is expected to be £3-4,000.

A 4¼-gal. fuel tank is carried under one side of the 2 × 2 aluminium frame, and is sufficient for 40 min. flying, plus reserves. Swath width with the present 14-ft. booms is 24 ft.; this is to be increased to 30 ft. by adding some 3 ft. each side. Although booms with Napier nozzles are currently fitted, rotary atomizers are also to be studied. Good results have so far been achieved from the McCulloch engine, which is cleared for 600 hr. between overhauls.

LEADING PARTICULARS

Dimensions.—Rotor diameter, 20 ft.; track, 5 ft.

Weights.—Basic, 329 lb.; fuel, 37 lb.; pilot, 170 lb.; payload, 100 lb.; max. take-off, 636 lb.

Performance.—Max. speed, 68 knots; cruising speed range, 28-50 knots; crop-spraying speed, 35-45 knots; initial climb, 650 ft./min.; landing speed, 15-20 knots; min. turning radius, 90-100 ft.; landing run, 10 yd.; take-off run (pre-spin), 50 yd.

Specialized Systems and Components

AMONG the aircraft companies which are of a special interest by virtue of an unusual history and industrial scope, Armstrong Whitworth Equipment of Hucclecote, Gloucester, takes a leading place. It provides an excellent example of the native talent for inspired adaptation and innovation.

When the Government of the day applied the closure to the thin-winged Javelin project in 1956, the Gloster Aircraft Co., transformed the nucleus of its engineering and research facility into a Technical Development Division (known as T.D.D.). This was expanded to cover the design, development and production of components and systems in the pneumatic, fuel, hydraulic, electronic and applied fields. It remained a part of its parent company until, with the reorganization of the Hawker Siddeley Group and the introduction of Hawker Siddeley Aviation, Ltd., it was married into Sir W. G. Armstrong Whitworth Aircraft, Ltd., in June, 1959.

Whilst at first sight this might seem to imply a transfer of allegiance, it enjoyed in fact, from the outset, a signal measure of autonomy, with complete freedom of action within its own terms of reference. The official seal may be said to have been set on this recognition of its identity, soon afterwards, when it was renamed Armstrong Whitworth Equipment or, as it is usually termed, A.W.E.

The strength of the division is now of the order of 400 personnel, of whom nearly 100 are technical staff. It is planned to optimize this size at between 500 and 550 in about 12 months' time. The additional numbers will be productive staff to give a more balanced ratio between the technical and manufacturing sides of the organization.

At the present time, approximately 60% of the components and systems marketed by A.W.E. go to aircraft companies and the remainder to commercial firms in other industries. Of the aeronautical sales 33% is to member companies of Hawker Siddeley Aviation, but this percentage is expected to grow as new aircraft are introduced by the Group.

A batch production organization, A.W.E. has concentrated its aeronautical products around fuel systems, with particular reference to couplings and proportioning valves; pneumatic equipment such as non-return valves and high pressure reducing units; and specialized components for other systems such as flowmeters originally developed for aircraft hydraulic rig circuits.

In the A.W.E. range of eight aircraft kerosene or gasoline fuelling couplings all of the parts, except one, are common and one type of seal is used. The one "variable" component is the body casing, which forms the basis of the unit and is produced in two sizes—1½ in. and 2½ in. nominal outlet diameter.

The fuel proportioning valves are designed to deal with the flows from two tanks, or groups of tanks, in a pre-set ratio over a flow range of 80 g.p.h. to 750 g.p.h. Employing a diaphragm-operated valve to control its two inlets, each unit will act as a non-return valve against the normal direction of fuel flow should the tank pressurization fail.

Missile Equipment

Fuel system components produced by A.W.E. also include a range of H.T.P. couplings and caps designed for missile pressure fuelling and defuelling. Based on the Avery-Hardoll kerosene unit, but incorporating changes of material to meet H.T.P. compatibility, these tank and hose couplings of ¾ in.-2½ in. nominal bore have undergone type testing at temperature ambient conditions.

Another H.T.P. component range is a series of reducing valves capable of bringing high pressures (3,000-4,000 p.s.i.)

Top, a general view of the A.W.E. main machine shop, with the Rolamat assembly line in the foreground. Left, a corner of the company's electrical and mechanical assembly section.

The A.W.E. hydraulic test bay, showing the equipment used in the setting up of the 144/5 electro-hydraulic servo-valve.

down to 10 p.s.i. in two stages—3,000 to 100 p.s.i. and 100 to 10 p.s.i.—to within ±0.25 p.s.i. Flows of up to 100 cu. ft./min. can be catered for by these latter units.

The A.W.E. pneumatic non-return valves are of the insert type and have bores ranging from 1¼ in. to 7 in. in diameter. The 4 in. dia. valve, for example, with a charged air mass-flow of 58 lb./min. at sea level and temperature of 50° C., has a pressure drop across it of less than 3.5 in. w.g.

High-pressure pneumatic reducing units include a valve designed to fit into the air supply line of an aircrew ventilated suit and one for supplying air at a controlled pressure to airborne radar equipment. Pneumatically operated and spring loaded in the open position, the ventilated suit valve reduces the air pressure to a fixed nominal pressure for varying pressures and temperatures of supply air, and for varying selected airflows.

Now suitable for use with a wide variety of fluids, the A.W.E. high-pressure (3,000 and 6,000 p.s.i.) flowmeters comprise two types covering four flow ranges from 0.5 to 30 g.p.m. Normally supplied with its own indicator, each flowmeter consists of a main body, in which is housed a tapered sliding plug, held in the closed position in a sharp-edged orifice by a main control spring. Fluid passing through the meter overcomes the spring force, thus displacing the plug by an amount which is a function of flow. This movement is transmitted to the indicator by means of a potentiometer.

In addition to its aviation systems and components, the other equipment marketed by A.W.E. can be divided under six main headings—servo-valves, process control, mechanical handling, system engineering, Hawker Siddeley secondary products and Penny and Giles potentiometers. Basically designed for the aircraft industry, all these units have been utilized for commercial applications without extensive alterations.

For example, the electro-hydraulic servo-valve unit originally developed for Javelin pitch stabilization has been employed by N.G.T.E. at Pyestock and by Bristol Siddeley Engines for powerplant test cell control, and for the remote control of machine tools from a separate console. In the mechanical-handling field the Rolamat aircraft-loading system developed by Armstrong Whitworth for the Argosy is now produced by A.W.E. in commercial form, and used in road haulage work.

Apart from its marketing and production organization, A.W.E. also has a number of test facilities, including high-altitude plant, fuel-system rigs and mechanical and electrical standards room. Having recently obtained Part 3 M.o.A. test-house approval, the division offers a comprehensive test service to industry within the confines of these facilities.

This service covers three sections. In the first comes environment testing, including high and low temperature, simulated fresh- and salt-water spray, fungus growth and the standard electrical and physical measurements associated with this testing. The second section covers performance testing of aircraft electrical rotating machines, including tests at high-altitude and humidity conditions, to a maximum output of 10 kW. at frequencies up to 2,400 c/s. Thirdly, there is the testing, calibration and check calibration of electrical measuring instruments used for DC voltage, current, power, resistance and frequency up to a maximum of 100 kc/s.

Radar Echo Identification

TRIALS have recently been conducted by Standard Telephones and Cables on the integration of an automatic triangulation direction-finding system into standard A.T.C. radar to aid the rapid identification of aircraft echoes without the need for additional airborne equipment.

Undertaken at the M.o.A. Air Traffic Control Experimental Unit at Heathrow, the trials employed the company's Type PVT.2 triangulation equipment using one commutated antenna direction finder (CADF) at London Airport and one at Ware, Herts; and closed-circuit television integrated with London Radar, the R.A.F. aircraft control unit. They were operated on the Amber Two Airway VHF channel.

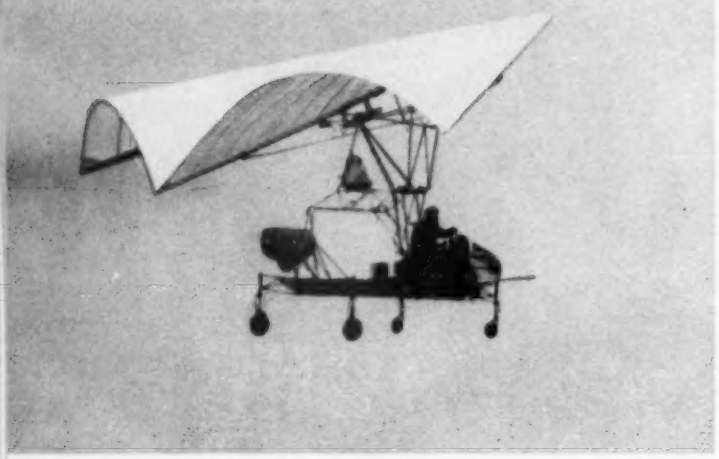
As in a standard installation normally employing four or more CADFs, the aircraft bearing information from the two DF units was fed to the experimental PVT.2 composite triangulation equipment and presented by a closed-circuit television monitor. The displayed aircraft "fix" could then be positioned by means of "joystick" control and transferred in the form of a spot onto the associated radar PPI display.

By operating the joystick as soon as a fix is shown on the PVT.2 monitor screen, the spot enables the controller to identify a particular radar echo as the aircraft that has made the R/T transmission. With the use of inter-console marking, this position symbol can be reproduced on all connected radar displays.

Although more applicable to military aircraft operating on random tracks, as opposed to well-defined civil traffic flying airways, this method of radar echo identification could be put to good use for the initial recognition of aircraft not equipped with secondary radar transponders. In addition to spot-type fix markers, other symbols such as a cross or a circle can be employed.

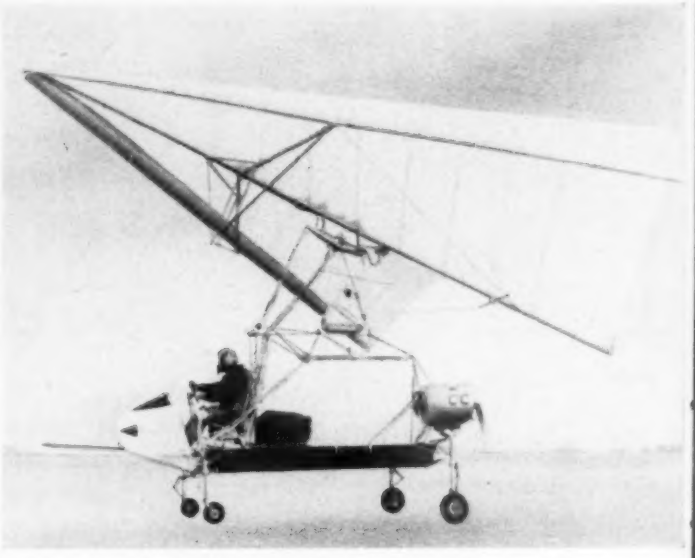
The overall accuracy of a CADF bearing is stated to be within ±1°, or one mile at a range of 60 miles; and the accuracy of a PVT.2 triangulation system fix is normally to within a radius of one mile. But this, of course, depends upon the number of CADF stations employed in a particular system. A minimum of four is recommended by Standard Telephones and a maximum 12 are available.

A standard A.T.C. radar console (right) with a monitor of the Standard Telephones triangulation system, linked to the "joystick" control which moves a marker across the TV screen to coincide with the aircraft "fix." The marker is duplicated on the PPI display in the form of a spot.

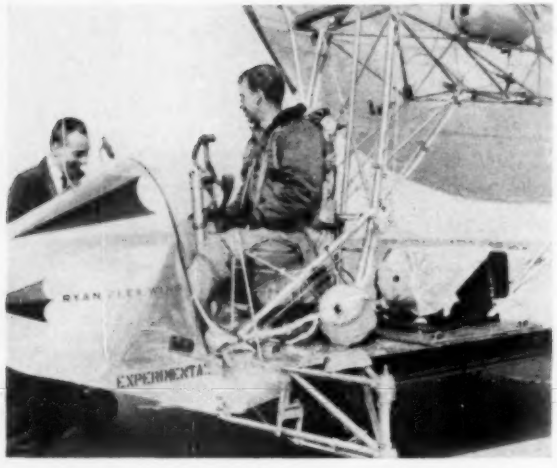


FLEXIBLE SUSTENTATION

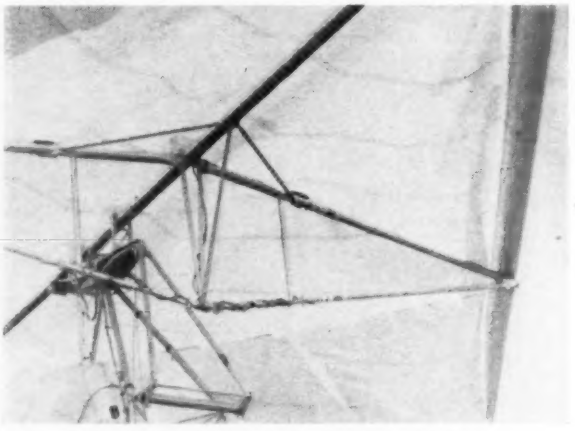
Howard Levy photographs

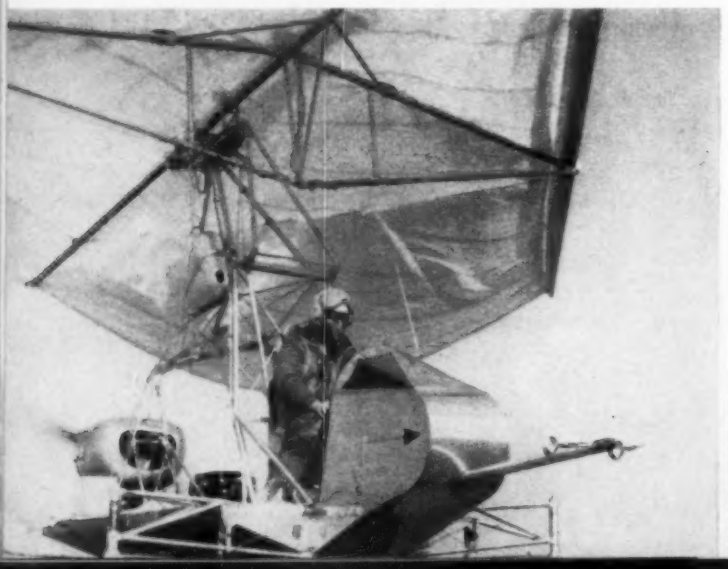


Details of a remarkable experimental aircraft being studied by the Ryan Aeronautical Corpn. in America are shown in these photographs. It has a flexible delta wing of coated nylon and is powered by a 100-b.h.p. Continental engine.



Above, Ryan's test pilot Lou Everett at the controls of the Flex-Wing; note the orthodox wheel and column used to control the craft by tilting the wing about the pylon seen also below and right in close-up.





The Flex-Wing in this experimental form is being used for preliminary assessment of the control and general handling characteristics of this somewhat unusual wing and control system. The work is being done by Ryan under contract to the U.S. Army Transportation Research Command.

Origins of the Thick Cantilever Wing

by H. Volker

IN an article on these pages (THE AEROPLANE AND ASTRONAUTICS, Dec. 23, 1960) the development of the thick cantilever wing has been traced from its inception until the time when the quest for better aircraft performance forced the braced thin biplane wing into virtual extinction. Since considerable interest has been shown in this important aspect of aviation history, the following notes have been prepared in an effort to emphasize further the work done by the pioneers in this field.

JUNKERS

The idea of the thick cantilever wing was first conceived in the mind of Prof. Dr.-Ing. e.h. Hugo Junkers (1859-1935), as evidenced by his handwritten draft dating from Dec. 3, 1909. In studying the relationship between aerodynamic lift and drag, Junkers arrived at the conclusion that the L/D ratio of an aeroplane could be improved considerably by replacing the thin wings of the biplane with its exposed struts and wires by a single, thick, internally braced lifting surface, containing all the essential components not employed in producing lift within its envelope. Based on these principles, Deutsches Reichs Patentschrift D.R.P. No. 235,788 was granted to Hugo Junkers of Aachen-Frankenburg on Feb. 1, 1910.

At the time when the thick-wing aeroplane was proposed Junkers was lecturing on thermodynamics at the Technical Academy in Aachen and had already several important practical inventions to his name, some of which were in production in his factory at Dessau. Examples were the gas geyser, well known in household use; the calorimeter, a measuring instrument used by gasworks; and the opposed-piston oil engine, which was initially developed for marine use and later into an efficient aero-engine. In this spirit Junkers set out to solve the multitude of aerodynamic and structural problems related to his thick-wing theory by intelligent practical experimentation.

In 1913, Junkers added a wind-tunnel to his research laboratory at Frankenburg Castle, near the city of Aachen, where he investigated the characteristics of elementary forms like spheres, cylinders and cones, as well as complete wing and fuselage shapes. Models and instrumentation were made in his own workshops. An interesting detail of these experiments was the method whereby the direction of the airflow passing over a surface could be made visible. A cold-water spray was directed into the tunnel test section, where it turned into distinct ice patterns on the surface of the model.

Junkers' wide experience in various branches of industrial research, design and manufacturing, especially with products made from thin sheet metal, directed his efforts towards the design of an all-metal thick-wing monoplane. Shortly after the outbreak of War, Junkers and his collaborators, O. Mader and O. Reuter, transferred the entire operation to the gas-geyser works at Dessau.

Early in 1915, two specimen wings were built at the Dessau works for load test experiments, followed by a third wing which was full size. Construction of the actual Junkers J-1 experimental single-seat monoplane progressed simultaneously with the third test wing, the aircraft being completed within the short time of four months.

The material used for the construction of the J-1 consisted of 0.1-mm. steel sheet. The work was complicated by the limited size in which the panels were available, and the fact that the properties of the material were not ideal for this particular application. The smooth outer skin of the aircraft was supported by corrugations.

During construction, extensive use was made of the electric resistance welding process, which had been sufficiently perfected for practical use at about that time. The wing had ribs made from U-section channel, but no spars; all loads were carried by the skin, its supporting corrugations and the ribs. Because of the previously mentioned small size of the steel-sheet panels, the wing was built up from prefabricated short-span, full-chord sections joined by welding along chordwise seams. A similar method was followed in the construction of the fuselage.

The Junkers J-1, which was appropriately named *Blechesel* (Tin Donkey), made its first flight from the Döberitz military training airfield near Berlin at 11.00 hrs. on Dec. 12, 1915. The pilot was Lieutenant Friedrich von Malinckrodt. Besides Prof. Junkers and his chief designer O. Mader, a young cavalry officer named Manfred von Richthofen, undergoing flying training at the time, was among the spectators attending this historic event.

The first flight was carried out in a straight line and at a very low altitude. During the landing, which was performed with the left wheel touching down first, the aircraft sustained some damage. The wing-to-fuselage joints failed and the wings became dislocated relative to the fuselage. Repairs were completed early in 1916 and subsequently the aircraft made a considerable number of successful flights.

It had the double distinction of being the first successful truly all-metal aeroplane, as well as the first thick cantilever wing monoplane in aviation history. Only one example of the J-1 was built.

The leading particulars of the aircraft were as follows:—

Engine, six-cylinder 120-h.p. Daimler-Mercedes D-II; span, 42 ft. 5⅞ in. (12.95 m.); length, 28 ft. 3⅜ in. (8.62 m.); wing area, 258.33 sq. ft. (24 m.²); aspect ratio, 7; empty weight, 1,984 lb. (900 kg.); total weight, 2,227 lb. (1,010 kg.); max. speed, 106 m.p.h. (170 km./h.).

Official performance trials conducted by the Army in February, 1916, indicated that the maximum speed of the J-1, measured over a two-way course, was 106 m.p.h. One of the fastest contemporary machines, a Rumpler biplane equipped with a 170-h.p. engine, attained a maximum speed of 93 m.p.h. However, climb performance of the J-1 was poor due to its high structural weight.

The J-1 was soon followed by a refined version, the J-2 single-seat fighter, which was structurally similar to its predecessor. However, in the meantime the military requirements had become more stringent, especially with regard to the climb and, as a result, only six J-2 aircraft were built. It was the first all-metal aircraft ever manufactured in quantity.

An interesting feature of the J-1/J-2 aircraft was the ducted engine-coolant radiator, placed in an underslung position similar to the familiar Hawker Hurricane. The principle of placing a radiator in a divergent/convergent duct, thus producing a measure of thrust which cancels a proportion of radiator drag, was another Junkers invention.

After the J-2, Junkers abandoned the steel-sheet construction method in favour of the familiar aluminium-alloy structure, with its chordwise corrugated skins supported on a framework of interconnected tubular spars.

With the exception of the J-4 armoured infantry support biplane, which was developed on instigation of the military authorities, all subsequent Junkers designs were fully cantilever, all-metal monoplanes. Subsequent military aircraft built by Junkers of aluminium-alloy construction were the equal of, if not better than, contemporary aircraft of more conventional design. However, certain misgivings prevailing in official circles prevented the Junkers designs from gaining the recognition they deserved.

In an attempt to combine the forces of creative research and productive capability, the military authorities forced an association between Junkers and Fokker. At the end of 1917, the Junkers-Fokkerwerke A.-G. "Jfa" was formed, much against the desires of both participants. The union automatically dissolved when the War ended.

FOKKER

Anthony H. G. Fokker (1890-1939) and his design staff under the direction of Reinhold Platz were quick to grasp the superior qualities of the thick airfoil. In 1916 they entered the field of cantilever wing design with the V.1 experimental sesquiplane, which first flew in December of that year. The V.1 had thick, tapered, cantilever wings, entirely covered with plywood. A peculiar feature of this aircraft was the total absence of interplane struts, made possible by the plywood covering, which provided adequate torsional rigidity to the wings.

At this point it should be stressed that the success of the Junkers and Fokker cantilever-wing aircraft at such an early date was made possible only by previous wind-tunnel experiments carried out on thick airfoils.

When Junkers was engaged in his aerodynamic research at the Aachen laboratory, work of a similar nature was under way at the Aerodynamische Versuchsanstalt at Göttingen where, under the direction of Professor Doctor Ludwig Prandtl (renowned for his boundary-layer research), the characteristics of numerous thick airfoils were systematically investigated in a wind-tunnel. From this work resulted the well-known family of thick Göttingen airfoils with their high camber and well-rounded curves, which were so eminently suited to accommodate the considerable construction height required for the spars of cantilever wings.

For obvious reasons the results of the German aerodynamic research did not become generally known until after the

Armistice. Unfortunately, it took some aircraft designers considerably longer to recognize its significance.

The famous Fokker wooden cantilever wing construction is often mentioned in aviation writing, but perhaps it is not generally known that several types of structure were used, some of which differed considerably.

For monoplanes, where the wing had to be torsionally rigid by itself, a plywood covering was used throughout. This method, first applied on the previously mentioned V.1 experimental cantilever biplane, was later used on the famous E. V/D. VIII parasol fighter of 1918 and subsequently on a long line of successful airliners, as well as on various military machines (D. XXI, T. IV, T.V, T. VIII-W, G.1, etc.).

At first the wings of all Fokker cantilever biplanes provided with interplane struts were almost entirely covered with fabric. To preserve the shape of the sharply contoured portion of the airfoil forward of the front spar, the fabric in this area was supported by thin plywood sheet. However, it can be seen from the accompanying sketches that this type of leading-edge, with its triangular cut-outs, did not provide a significant contribution to the torsional rigidity of the wing as a whole. This form of wing construction was widely used on early biplanes (D.VII, C.I, C.II, etc.) and on the Dr.1 triplane.

Drag bracing in the early biplane wings was achieved by diagonal wires between the spars and, in some instances, distance tubes. On later aircraft (C.IV, C.V, etc.) this form of drag bracing was deleted in favour of a partial plywood covering extending forward from the top of the front spar, around the leading-edge and aft to the bottom of the rear spar. Rigidity against drag loads was provided by the flat portion of this plywood covering at the underside of the wing between the spars.

An interesting example of careful design, shown in the sketches, concerns the manner in which the fabric was protected from joining the plywood covering too abruptly in chordwise direction.

In most Fokker wings the spars ran parallel along the full span. This feature facilitated installation of the solid web-type ribs, which were prefabricated in one piece. Once installed, the rib flanges continued uninterrupted over the top and under the bottom of each spar. This method somewhat reduced the effective spar height, but made for easy production.

The box-type spars consisted of laminated spruce top and bottom flanges and birch ply webs. Stability against buckling of the webs was provided by tiny internal diaphragms, and by the filler blocks provided in locations where brackets were installed for the wing-to-fuselage attachment, interplane struts, engine mounts, if any, etc. Individual spar flanges, as well as the complete spars, tapered towards the tip in proportion to the reduction in applied bending moments.

In later years Fokker produced monoplane wing spars answering to both dihedral and sweep-back. Since these wings were always made in one piece, an ingenious method was devised to avoid complication and material waste during fabrication of the spar flanges. The spar-flange laminæ were canted at an angle, proportional to spar dihedral and sweep-back. Each laminate was built up from the usual spruce material with a lower-grade wood selected for the areas outside the contours of the finished flange. Subsequent lamination was easily accomplished and would result in a straight rectangular beam. The final stage of the operation simply consisted of removing the excess low-grade wood with a minimum of waste in expensive spruce material.

The rôle of the interplane struts on the Fokker Dr.1 triplane, the D.VII biplane fighter and their successors has been a long-standing subject of controversy. The individual fabric-covered wings of the Fokker biplanes did not possess adequate torsional stiffness. Torsional rigidity of the wings on these aircraft was completed by the interplane struts which, contrary to many published statements, were there for a purpose.

On the Dr.1 triplane the wing-spar arrangement was different from all other Fokker aircraft. The spars were very closely spaced and joined by horizontal diaphragms connecting the top and bottom spar flanges. This double-box spar made further drag bracing unnecessary and, in addition, must have provided a fair amount of wing torsional rigidity. The covering of the triplane wings was the same as on the D.VII, entirely fabric with a thin plywood covering in the leading-edge area.

In analysing the function of the Dr.1 interplane struts and their peculiar spar attachment fittings, the following observations can be made (see sketches):

(a) The longitudinal hinges in the interplane strut/spar attachment fittings permitted the spars to flex freely when subjected to wing-bending loads.

(b) The single broad interplane struts were well suited to absorb and distribute individual wing torsional loads, the substantial fittings and hinge bolts preventing rotation of the double box spars around their spanwise axis.

(c) The wings were kept equidistant under all flight conditions, which reduced the possibility of vibration and flutter, especially at high flying speeds.

(d) It is interesting to note that the spar attachment of the interplane struts on the Sopwith triplane, although not identical to that of the Fokker Dr.1, was of the same basic configuration.

In view of these facts there is strong reason to believe that the decision to fit interplane struts between the wings of the experimental V.3 triplane prototype (which change, together with the fitment of balanced ailerons, gave it the V.4 designation), was arrived at after flight testing proved that the torsional rigidity of the individual wings was less than anticipated and that wing vibration was excessive. Consequently, the charming anecdote about the suspicious army officials who were obligingly placated by the fitment of "dummy" struts between the wings of the triplane prototype should be accepted as such in spite of several authoritative sources. The original absence of the struts appears to have been a matter of optimism—and not entirely without reason—on the side of the designer of this great little fighter.

In conclusion, it should be noted that not all Fokker biplanes were of the "wireless" type; some of them, like the D.XVI, D.XVII, C.X and C.XI-W, were fully braced with struts and profile wires.

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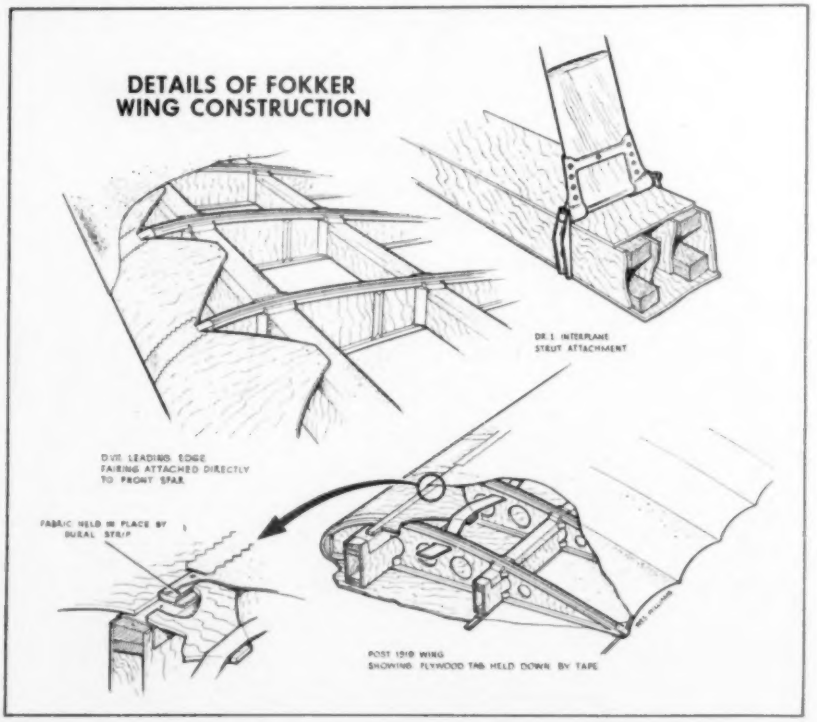
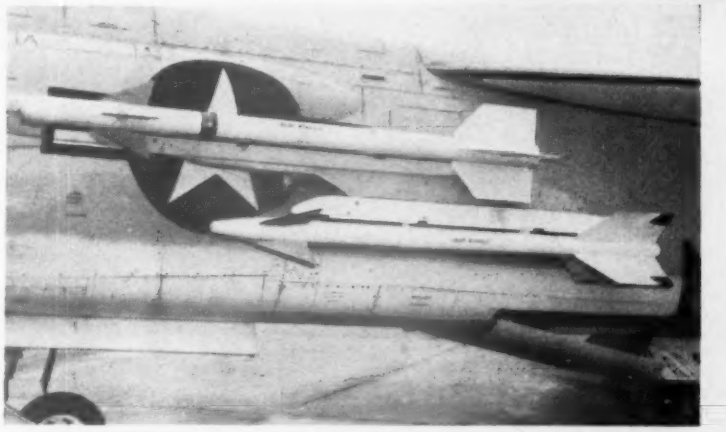


MISSILE MISCELLANY

Howard Levy photographs

Above, land-based Terrier anti-aircraft missiles are in service with the U.S. 1st Marine Medium Anti-Aircraft Missile Battalion; Terrier is normally ship-based and used by the U.S. Navy. Right, first view of armament racks on the Convair F-106A with four Hughes GAR-3A Falcons installed; the racks completely retract into the internal bomb-bay.

Above, an experimental XM-1 Sergeant combat rocket on its launching station/transporter. Both XM-1 and support equipment were developed by Sperry-Utah, following initial design by the Jet Propulsion Laboratory, Calif. Institute of Technology. Sergeant is approximately 34 ft. long and 2½ ft. in diameter; its maximum range is 100 miles.



Above, Sidewinders installed on the Chance-Vought F8U-2N Crusader—the model 1A at top and 1C below. Note change in fin configuration, nose, shorter length and fin stabilizers on the Sidewinder 1C.

Left, a two-stage Pershing on its transporter-erector-launcher which permits its operation on a "shoot and scoot" principle. Four tracked vehicles make up the complete Pershing field unit.

Canada's Rocket Programme

HIGH-ALTITUDE research rockets have been under development in Canada since 1956 when the Canadian Armament Research and Development Establishment (CARDE) at Valcartier began to investigate solid rocket propellents of improved performance and storage characteristics. At this particular time, the United States was concerned mainly with liquid propellent rockets and the Canadian Defence Research Board felt that, because of the problems and dangers associated with liquids and the time required for fuelling prior to firing, a solid propellent research project would serve a more useful purpose.

The existence at the Valcartier laboratory of an unusually well-designed pilot propellents plant, employed some years before in developing propellents for Canadian Army shells and latterly for the Heller anti-tank rocket, suggested that CARDE was the obvious place for a rocket propellent research centre.

The programme began with an extensive laboratory investigation of various propellent combinations, and this was followed by static tests first of 8-in. and then of 17-in. diameter rocket motors containing selected propellents. The performances of the various combinations were compared following measurement of such parameters as rate of burning and thrust.

The next stage was to conduct firing trials at the Fort Churchill rocket station in Manitoba and for this purpose propellent test vehicles (Black Brant I) and later, research rockets (Black Brant II) were put to test, attaining altitudes of up to 100 miles. Both these rockets are similar in appearance being approximately 24 ft. long, 17 in. in diameter and containing some 2,000 lb. of solid propellent.

In view of the success of the initial launchings, it was decided to instrument the nose cones of Black Brant rockets for the purpose of obtaining information on the upper atmosphere, and during subsequent firings, payloads of 150 lb. were embodied. These have served both to measure the performance of the rocket and its engine and to investigate specific upper atmospheric phenomena, the data being telemetered to recording stations on the ground.

Experiments in the upper atmosphere have also been conducted with Black Brants instrumented by the Defence Research Telecommunications Establishment (DRTE) at Shirley Bay, near Ottawa, while experiments are also being devised by the National Research Council and by Canadian Universities.

The information sought in these research programmes is of special interest to Canada because of the disturbed conditions in the upper atmosphere common to high latitudes (e.g., the aurora borealis) which seriously affect long-range radio communications employed by the Armed Services, and others. Of further interest is that the scientific information obtained and transmitted to United States defence scientists, concerning the various types of background radiation in the upper atmosphere, may prove useful in the eventual development of a foolproof system of I.C.B.M. detection.

Although a fire seriously damaged the Fort Churchill launching site earlier this year, the range head is now being rebuilt and plans are advanced for the launching of a new series of sounding rockets designed to carry payloads of 25 to 250 lb. to altitudes from 100 to 600 miles. These are Black Brant III, a single-stage vehicle of 10 in. diameter; Black Brant IV, a two-stage model employing a 17-in. first stage with a second stage of 10 in. diameter; and Black Brant V, which is again single staged with a diameter of 17 in.

Launching of Black Brant from the Canadian rocket station at Fort Churchill in Manitoba.

The rockets will utilize the Canadian solid propellents developed at CARDE and will take advantage of the experience already acquired with Black Brant I and II. Bristol Aero-Industries, Ltd., have been engaged on the design work as a private venture over the past two years, and actually were responsible for proposing the programme to the Canadian Government.

In addition to the various interests of Canadian official establishments and universities, it is hoped that other countries may purchase the rockets for use in their own research programmes. The possibility has also been expressed that NASA and the United States Armed Services may adopt them in line with the Canadian/United States Defense Production Sharing Program.

Testing Ion-drive in Space

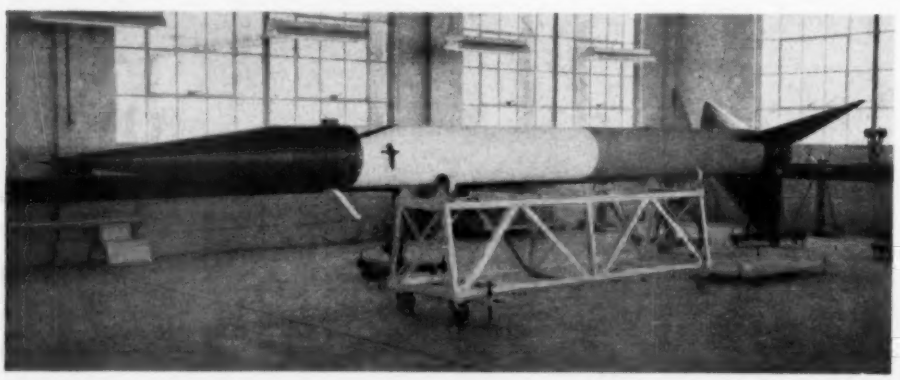
A SIGNIFICANT step in the development of electrical propulsion systems for space-vehicles is contained in the announcement of Jly. 17 that NASA is to place a contract for a "payload capsule" for the purpose of flight-testing small ion engines. Of 16 companies submitting proposals, the Astro-Electronics Division of the Radio Corporation of America was selected by the Marshall Space Flight Center.

The contract involves designing, building and testing seven capsules, three for ground tests and four for actual flight operation. Each capsule will contain two electric engines.

First of the flight capsules is scheduled for launching by a Scout rocket in the last quarter of 1962; it will carry one caesium-fuelled and one mercury-fuelled ion engine, operating from 1 to 2 kW. of electrical energy. The engines are being developed respectively by the Hughes Aircraft Company and NASA's Lewis Research Center.

The need for conducting flight tests in a true space environment has been apparent for some time. This is because the exhaust beam of an ion engine is influenced by the walls of

(*Continued on page 111*)



The Canadian research rocket Black Brant I.

ROLLS-ROYCE

SPEY

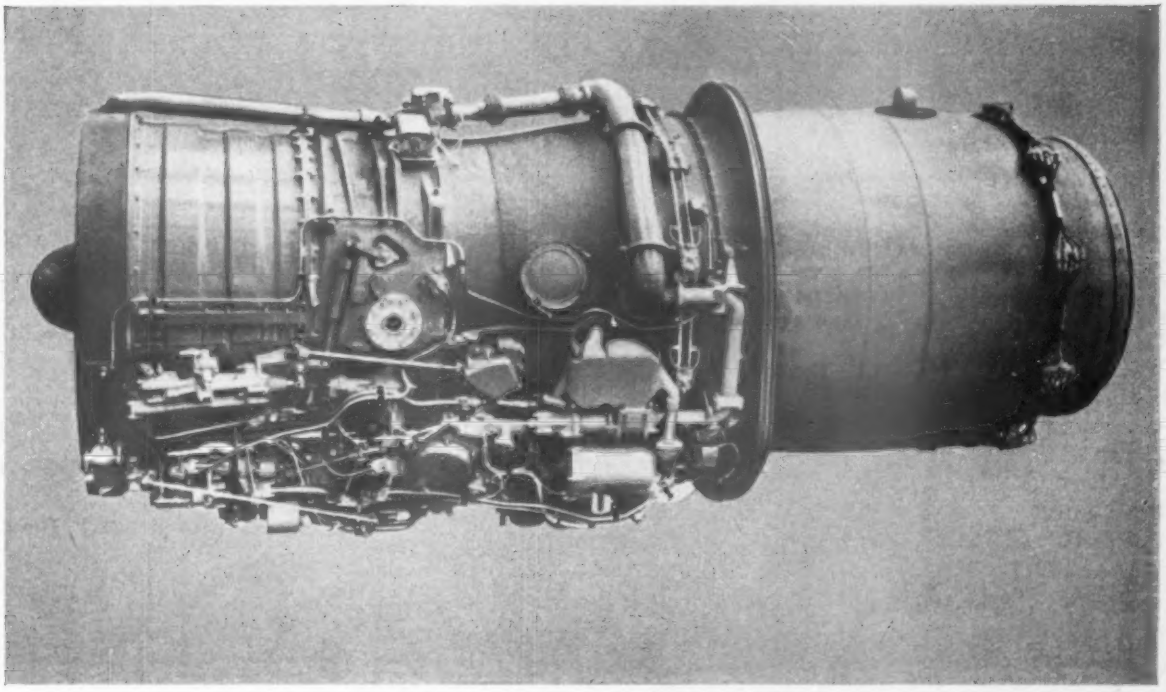
BY-PASS JET

WILL POWER THE

DE HAVILLAND TRIDENT

B.A.C. ONE-ELEVEN

BLACKBURN BUCCANEER 2



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(*Continued from page 110*)

even the largest feasible vacuum tanks. Propulsion is obtained by the expulsion of charged particles which are accelerated by electric or electromagnetic fields. In this way, very high exhaust velocities can be produced with low engine temperatures. Thus ion engines, operating on micro-*g* accelerations, offer higher specific impulses than chemical engines. Other advantages lie in their small size, low fuel consumption and capability of being stopped and restarted at any time during flight. They cannot, of course, be used to accelerate a vehicle from the Earth's surface, but once established in orbit by a high thrust chemical rocket, they show promise of many applications where the use of small thrusts over long periods is desirable.

Possible future applications may be found in: (a) communication satellites which must keep their position and altitude accurately over periods of years; (b) interplanetary voyages to Mars, Venus or Jupiter where continuous engine operation can markedly reduce transit times; (c) transferring heavy loads from a low satellite orbit into a high orbit, which involves restarting of the propulsion unit; and (d) deep space probes, which must travel great distance in a reasonable time to obtain useful results.

Apart from research problems connected with the engine, one of the principal difficulties is that of developing a suitable lightweight electrical generator to run the engine at an adequate power level for the required missions.

The Vostok Booster: Comment from Huntsville

WHEN the Soviet authorities placed certain details of the orbital flight accomplished by Major Yuri Gagarin in the Vostok spacecraft before the Fédération Aéronautique Internationale in May, they included the information that the rocket booster "had six engines at the moment of launching with a total thrust of 20 million h.p." (Ref. 1). Ever since, there has been speculations concerning the exact meaning of this figure in terms of kilograms, or pounds, thrust and the precise configuration and engine arrangement adopted for this large rocket vehicle.

As we pointed out at the time, the Marshall Space Flight Center had previously quoted the horse-power of the 1.5m.-lb.-s.t., eight-engined, Saturn booster as being equivalent to 32 million h.p., and in a technical note (Ref. 2) published on Jne. 15, Mr. A. V. Cleaver, chief engineer, rocket propulsion, of Rolls-Royce, Ltd., outlined three senses in which the horse-power of a rocket system might be said to have some meaning.

We have now received from Mr. Harry Ruppe, Assistant Director, Future Projects Office, George C. Marshall Space Flight Center, in Huntsville, some further comments which bear on the arguments expressed. Mr. Ruppe begins by confirming that the horse-power figure for Saturn was derived, as supposed by Mr. Cleaver, from the expression:

$$\text{Thrust horse-power rating at booster cut-off} = \frac{\text{thrust (kg.)} \times \text{speed (m./sec.)}}{75}$$

$$= \frac{(800 \times 10^3) \times (3 \times 10^3)}{75}$$

$$= 32 \times 10^6$$

From the Soviet colour film, "The First Journey to the Stars," mentioned by Major Gagarin at his Press conference in London, this "still" shows the astronaut being assisted into the ejectable capsule which is mounted in the Vostok spacecraft. The capsule is similar to that which contained the two dogs Strelka and Belka, pictured in our issue of Jne. 8, 1961, p. 683.

Payload and Propellents

The Saturn C-1 has the capability of placing a payload of about 20,000 lb. in a low circular orbit. In contrast, Mr. Ruppe points out, the Soviet booster may deliver 12,000 to 14,000 lb. into a similar close orbit, but the two vehicles may be very different in conception. The initial Saturn in its two-stage configuration is staged far from optimum and employs liquid oxygen and liquid hydrogen as upper stage propellents. The Soviet vehicle might differ in each of these respects.

However, a "naïve" scaling results in a lift-off thrust of:

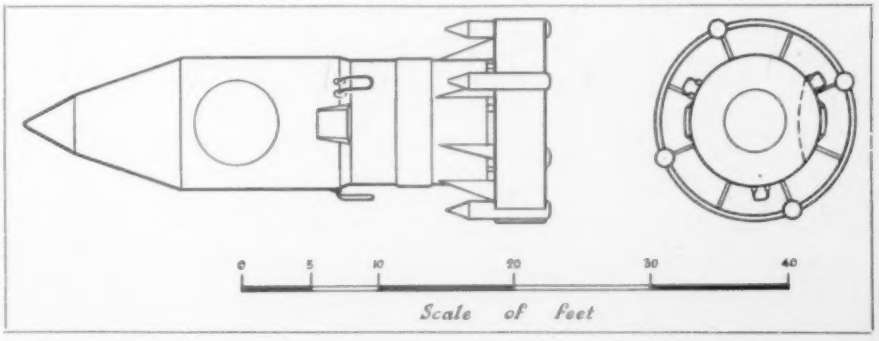
$$\frac{14{,}000 \times 1{,}500{,}000}{20{,}000} = 1{,}050{,}000 \text{ lb.}$$

and a lift-off weight of 850,000 lb.

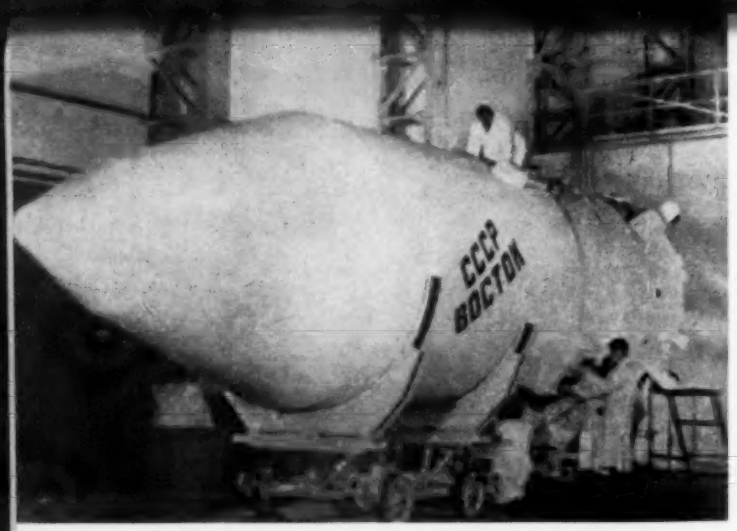
If we approach the problem from another direction, says Mr. Ruppe, the results can be made rather different. Assuming an ideal speed requirement of 9.5 km./sec. (5.9 miles/sec.), an average specific impulse of 306 seconds, and a structure ratio of 0.1 for each stage, an approximately optimized two-stage configuration would have a mass-ratio of 4.86 per stage, a payload ratio of 0.106 per stage, and a growth factor of about 90. With a payload capability of 12,000 lb., this results in a lift-off weight of 1.08 million lb., and a lift-off thrust around 1.3 million lb. These, however, are not "too far" removed from the "naïve" figures, and the data given in Table I might be assumed (see over page).

This is evidently the right order of magnitude for the payload, but what about the other information, asks Mr. Ruppe. If the six engines refer to the first stage only, then we have a thrust of about 220,000 lb. each, and one of these engines might power the second stage.

If, however, the *total* number of engines in the vehicle is



This diagram of the Vostok spacecraft has been drawn from the evidence of the exhibit seen at Tushino earlier this month. On the outside of the vehicle are mounted, according to the Russians, "control units, orientation elements, shutters of the temperature control system, and radio aerials." Total weight is 10,418.6 lb.



From the Soviet documentary film, "Journey to the Stars," this picture shows the two main sections of the Vostok spacecraft being assembled. The tail annulus seen at Tushino is noticeably absent.

six, then the booster may have five engines of 260,000 lb. thrust each, and one of these engines might be in the second stage. This, he says, agrees fairly well with certain other information:

(1) The Soviet booster tests impacting in the Pacific Ocean are believed to have used boosters of around 1,000,000 lb. lift-off weight. This would represent the first stage.

(2) The Soviet T-3 ICBM is believed to have 480,000 lb. thrust in its first stage (two x 240,000-lb. engines?).

(3) The T-3 is believed to have 268,000 lb. thrust in its second stage, which may be a single-engine altitude version of the type used in the first stage. This stage could therefore be the second stage of Gagarin's booster, and five of these engines could power its first stage. As an alternative, six of these engines, either down-rated to 240,000 lb. thrust or having "engine-out" capability, could be in this first stage.

The horse-power rating at cut-off of the first stage comes out to 24.2 million h.p., which is not too far from the 20 million h.p. quoted to the F.A.I. At the time of injecting the payload into orbit 20 million h.p. would correspond to a thrust of 420,000 lb. Thus, this interpretation is very unlikely.

Many other possibilities exist. Mr. Cleaver has already pointed out some: a three-stage vehicle, different propellents, or different engines per stage. On this basis, four engines of 330,000 lb. thrust each could power the first stage while two engines of 77,000 lb. thrust may be in stage two. There are numerous arrangements which could be employed and, Mr. Ruppe concludes: "It is to be hoped that the Soviet Union will remove their traditional cloak of security from their otherwise impressive space exploration programme.—K.W.G.

TABLE 1: Speculations on the Vostok booster, assuming a two-stage configuration (H. Ruppe, Marshall Space Flight Center).

FIRST STAGE	
Lift-off weight	1 million lb.
Lift-off thrust	1.3 million lb.
Average specific impulse	300 sec.
Characteristic velocity	2.8 miles/sec.
Mass ratio	4.78
Cut-off weight	209,000 lb.
Cut-off time	182 sec.
Cut-off velocity	1.9 miles/sec.
Payload weight	144,000 lb.
Empty stage weight	65,000 lb. comprising:— 15,000 lb., engine; 40,000 lb., structure; 7,000 lb., residuals; 3,000 lb., interstage structure.
SECOND STAGE	
Weight at ignition	144,000 lb.
Thrust	75,000—300,000 lb.
Vacuum specific impulse	310 sec.
Characteristic velocity	3.0 miles/sec.
Mass ratio	5.02.
Cut-off weight	28,700 lb.
Cut-off time	480, 120 sec. after ignition of this stage.
Empty stage weight	14,000 lb. comprising:— 2,000 lb., engine; 8,000 lb., structure; 2,000 lb., residuals; 1,000 lb., guidance and control; 1,000 lb., payload adapter.
Payload weight	14,700 lb.

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1 K. W. Gatland, "Russia's Six-engined Booster," THE AEROPLANE AND ASTRONAUTICS, Jne. 8, 1961, p. 647.

2 A. V. Cleaver, "Vostok Thrust Figures," THE AEROPLANE AND ASTRONAUTICS, Jne. 15, 1961, p. 703.

Midas at Kirkbride

DECISION to establish a ground readout station for American Midas surveillance satellites at R.A.F. Kirkbride, Cumberland, is an indication of the coming utility of military space systems. In full operation there will be some 12 to 15 Midas satellites in continuous orbit over the Poles, each having infra-red sensing equipment capable of detecting ballistic missiles as soon as they leave their launching pads. As the Earth rotates beneath the orbit, every part of the World will become available for scrutiny. The system will, of course, depend as much on the efficiency with which the data is processed on the ground as with the functioning of the satellites.

The sensitive space-borne equipment now being tested in experimental firings (see table below) is said to be capable if discriminating between heat point sources on the ground (e.g., blast furnaces) and those of ascending missiles. Needless to say, reliability will be at a premium in a space system of this kind, and the satellites must have sufficient power supplies to maintain their orientation (nose-down to the Earth) for a considerable time. Moreover, if the system is to be maintained at full operational strength, replacement satellites must be constantly available at launching sites to fill the gaps left by failures of those on "standing patrol."

	MIDAS I	MIDAS II	MIDAS III
Launched	Feb. 26, 1960	May 24, 1960	Jly. 12, 1961
Site	Cape Canaveral	Cape Canaveral	Point Arguello
Lift-off weight	260,000 lb. (approx.) (Atlas-Agena A)	260,000 lb. (approx.) (Atlas-Agena A)	263,500 lb. (Atlas-Agena B)
Orbit	33° to equator (failed to orbit)	33° to equator, perigee 292.1 miles; apogee 322 miles; period 94.3 min.	Near-polar, near-circular at 1,850 miles, period 106 min.
Total weight in orbit (including empty top stage)	4,500 lb. (approx.)	5,000 lb. (approx.)	3,500 lb. (?)
Satellite dimensions (including top stage)	22 ft. x 5 ft. dia.	22 ft. x 5 ft. dia.	30 ft. x 5 ft. dia.

This table lists the total Midas launchings to date. Payload, of unspecified weight, includes IR-sensor, telemetry and communication equipment. Midas I was unsuccessful because the second stage failed to separate; Midas II suffered a failure in the data link transmitter carrying IR-scanner information to ground stations after two days; and Midas III was successfully placed in a high (operational-type?) orbit using the restartable Agena-B engine system.

The Midas system cannot, of course, operate unless ground stations are available at strategic points for feeding the information received quickly and efficiently into the overall defence system. The information received at Kirkbride, said Mr. Julian Amery, the Secretary of State for Air, in the House of Commons on Jly. 19, will complement that provided by the Ballistic Missile Early Warning Radar System being established in Alaska, Greenland and Gt. Britain. It will give even earlier warning than the B.M.E.W.S. system, he said; and will make it even more difficult for an enemy to launch a successful surprise attack on Western strategic deterrent forces.

The Secretary of State continued:—

"Kirkbride will be commanded and operated by the R.A.F. Warning information from Midas satellites will be available simultaneously to operations centres in the United Kingdom and the United States, and to the Supreme Allied Commander, Europe.

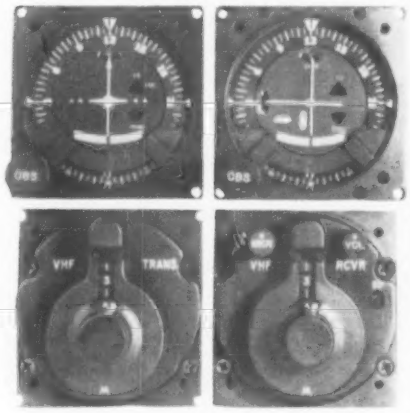
"The United States will provide and install the special equipment for the station and the communications required to link it with the United States. The United States will also defray, in the first instance, the cost of the technical works services required to make the station operational. The United Kingdom will repay these costs within an agreed limit, after the station becomes operational. . . .

"The capital cost of the station to this country is expected to be in the region of £2 million to £3 million. Its capital cost to the United States is expected to be about £10 million. But this latter figure is, of course, a very small part of the projected United States expenditure on the system as a whole. The United States Government have already allotted £150 million for Midas, of which well over half has already been spent."

Personal Flying

SEVERAL new products have been introduced by Motorola Aviation Electronics, Inc., of Culver City, California, which produces an extensive range of high-quality light aircraft radio, navigational and autopilot equipment. One of the most interesting and advanced developments is the all-transistorized automatic direction-finder ADF-T-12. This was produced as a miniaturized version of the standard ADF-12 as a result of 20 years' experience of the Lear company with the design and manufacture of LF direction-finders, in conjunction with the extensive background of Motorola in transistorized radio communications systems.

In outward appearance, the ADF-T-12 receiver is exactly similar to the ADF-12E tuner, but is a complete, self-contained LF set weighing only 5 lb. It receives radio range, communications and broadcast frequencies from 190 kc/s. to 1,750 kc/s., over three bands, with exceptional sensitivity.



The Motorola VHF Navigation/ Communication System.

The only other components are a fixed-loop antenna, the size and thickness of a paper-back book, and a standard 3-in. azimuth indicator, which is an automatic goniometer (resolver) and ADF indicator system combined. Total weight of the complete installation is only 9.5 lb., and the U.S. price, around $1,100.

Motorola has also developed the new "building block" M-135 Nav/Com system, which was designed to supersede the LNC-100 system. Starting with the Model 5642A transmitter, and the 5613A receiver, it is designed as a packaged unit to take up to eight or more components. These can be added as required, and include a navigation system with VOR/LOC indicator; marker-beacon receiver; ILS glide-slope cross-pointer; two VHF/Nav receivers; and a stand-by VHF transmitter.

The basic Com equipment is available in the new 360/560 channel extended frequency range (135-95 Mc/s., with 50 kc/s. spacing), or the standard 90/190-channel model (126.9 Mc/s. with 100 kc/s. spacing). If extended frequency is not immediately required, plug-in crystals and filter for additional channels may be incorporated at any time. Various combinations of this equipment are available, ranging from $1,245 for the basic VHF transmitter and receiver, to $6,190 for the more comprehensive assembly.

Third new member of the Motorola family is the L-2 three-axis autopilot, with a remarkable range of facilities for the low-cost field. These include, automatic ILS approach coupler, constant bank turns, turbulence cushioning, constant angles of climb and descent, automatic heading and altitude control. An automatic trim change facility is also incorporated for the elevators.

The L-2 is all-electric. In addition to the standard on-off switch, miniature control box, directional and attitude gyros, it includes an amplifier, dynamotor, operating servos with powdered-iron particle clutches, trim tab servo, and variable voltage two-phase transformer follow-ups to supply control surface displacement.

The Motorola L-2 is FAA-approved for all well-known business aircraft, both single- and twin-engined, and has been installed in all types from Tri-Pacers to Twin-Beeches. Price averages around $6,000, complete.

• • •

Trade restrictions in Australia have postponed production of the Victa R-2 four-seat tourer, which was designed by Luigi Pellarini, and made its first flight at Schofields, N.S.W., on Feb. 15 in the hands of Flt. Lt. R. Green, R.A.A.F. The all-metal R-2 has a 180-b.h.p. Lycoming O-360 driving a McCauley constant-speed airscrew, and a retractable tricycle undercarriage.

The smaller two-seat Air Tourer developed by Victa Consolidated Industries is continuing on a revised programme, which covers production of 50 up to 1962.

• • •

Statistics have been likened to a Bikini swim suit; what they reveal is interesting but what they conceal is vital. Nevertheless, the 1960 figures for "general aviation" in the United States cannot fail to impress, although it is more difficult to follow the optimistic growth forecasts for the immediate future by linear extrapolation of the past few years' performance.

During 1960, the American lightplane industry delivered 7,588 new aircraft, to a total value of more than $201,600,000. This represented a slight decrease in units over the previous year, but a considerable rise in retail value, because of the greater number of more expensive twin-engined types.

In the U.S., there are 6,426 registered airports, of which the airlines use only 566. There are 349,000 licensed pilots in general aviation, with only 54,000 instrument rated. In all, 108,000 civil aircraft were registered on Jan. 1, 1961, of which 30,000 were inactive, and 2,000 belonged to commercial carriers. This left 76,000 general aviation types.

Total general aviation hours flown were estimated at 13 million, of which approximately 6.1 million were on business trips. General aviation carried 57% of all America's 103,790,868 civil passengers during 1960.

• • •

Sixteen students started full-time training at Elstree for commercial pilot qualifications on Jne. 16. In addition to a C.P.L., each is working for a full or assistant instructor's rating, and, following a comprehensive flying and ground syllabus, M.o.A. examinations will be taken in November.

Next term for *ab initio* students at the London School of Flying starts on Sept. 19, while P.P.L. holders may join from Oct. 24. Seven vacancies were reported for this intake, which is the last until spring, 1962. The L.S.F. has a waiting list of P.P.L. students, both full- and part-time, with 58 undertaking their training within a period of six months. With the C.P.L. students and others are 84 training pilots at Elstree.

In May 720 hr. 35 min. were flown there, while the associated Midland School of Flying has started training students on the Rolls-Royce works flying scheme for the Merlin Flying Club. About five Rolls-Royce employees are receiving regular instruction. The Midland School flew 201 hours in May.

● The Southport Aero Club, which for many years used to operate from the beach at Hesketh Park with a Tiger Moth, has moved to Woodvale, and has obtained a rather more modern

PARIS PROTOTYPE.—Initial appearance of the new Siebel SIAT 222 four-seat all-metal tourer, powered by one 180 b.h.p. Lycoming O-360 engine, was made at the recent Paris show at Le Bourget. Max. speed is nearly 200 m.p.h.

Photograph copyright "The Aeroplane and Astronautics"

aircraft in the form of the two-seat Aircoupe. This has proved very popular with the members, and has enabled the club to exceed by a substantial amount its target hours each week since commencing operations. Day trips have been made as far south as Bembridge, and the club is enjoying the assistance of two honorary instructors. They are Mr. R. Leach of Airwork, and Flt. Lt. Shelton of the Royal Air Force.

● May was a record month for the Denham Flying Club, with the two Piper Colts and the Chipmunk kept very busy in excellent weather. Rosemary Kirby has joined the staff as an assistant instructor.

● The Kingfisher Flying Group (P.F.A. Group 82) has taken delivery of an Auster 4, G-ANHL, at Panshanger, where it is being hangared and looked after by the London Aero Club. The Auster, which is fitted with VHF, is being operated at £4 10s. an hour, but it is hoped to reduce this figure to about £3 10s. or less, after receipt of a P.F.A. Trust Loan to complete the purchase of the aircraft.

● New additions to the Tiger Club at Redhill are another Jodel D.117, G-ARNU, which is not fitted with air-brakes, and a Druine Condor. The chairman, Norman Jones, has also obtained a Stampe biplane, which is the first to be registered in this country. Aerobatic pilots in the Club will benefit from the four sets of ailerons, which give a greatly improved rate of roll compared with that of the Tiger Moth, and also from the 150-b.h.p. Renault, which will run three minutes inverted.

Gliding Notes

by Dr. A. E. Slater

ONCE again the English Channel has been crossed in soaring flight. On Jly. 5 Alfred Warminger nominated Troyes, 88 miles S.E. of Paris, as his goal and took off at 11.05 in his Olympia 419 from Swanton Morley in Norfolk by aero-tow, from which he released over Foulsham, four miles north. He could not make it, but at 18.50 he came down by a disused airfield at Rosières-en-Souterre, 15 miles E.S.E. of Amiens, exactly on track between his French landfall and Troyes. The distance was 225 miles from release point.

The full distance would have been about 349 miles. This is still 10 miles short of Nicholas Goodhart's British goal-flight record of two years ago from Lasham to Portmoak in Scotland.

Warminger found soaring conditions "superlative" over England and averaged 43 m.p.h. to Folkestone in a moderate wind from N.N.W., crossing the Thames from Bradwell to Whitstable. But by Folkestone, in the corridor-free area, it took him an hour and a half to get 5,000 ft. However, he continued in lift for the first half of the crossing, and was still at 4,000 ft. on reaching a point N.E. of Cap Gris-Nez.

The air was dead for the first 15 miles inland over France and then he encountered shallow cumulus at only 2,500 ft. But the rest of the flight, from 16.15 onwards, was mostly a scrape; he was down three times to 1,000 ft. or less, and once was saved by a bonfire from a field where he was expecting to land.

Unfortunately the airfield at Rosières was not fit to land on, still less to tow out of, and he had to come down outside it in a field of sugar beet. Warminger's crew arrived at 13.50 next day with the trailer, having crossed by sea before getting news of where he was, as it had taken him more than four hours to get through by phone to England.

The instability of Warminger's air can be accounted for by its Arctic origin; in fact, the weather chart of the day before shows Swanton Morley and the North Pole to have been on the same isobar. But the upgoing air he got over the Channel must have risen from the land, for it was warmer than the sea. Surface temperatures over East Anglia at noon varied from 16°C. to 19°C., rising later to 18-21°C., whereas the Channel temperatures should have been about 16°C. or 17°C. Gatwick was 19°C. at noon and 21°C. in early afternoon.

Nobody has yet soared across the Channel in the opposite direction. One possible technique is to find a French cu-nim outside an airway from which to make a glide across in clear air. But in the classical "summer thunderstorm" situation with a hot S.E. wind blowing to England from the Continent, the instability is produced by a cold upper wind from S.W., which has come from the Arctic on a curved course over the Atlantic. So anyone spending too long in a thunderstorm, expecting it to move with the surface wind, would emerge unexpectedly over the North Sea.

* * *

SOME excellent cross-country flights were made in England in pre-War years with an imported Rhönsperber, a mid-wing type with a "gull" wing, of which the Kranich was essentially a two-seater version. Hans Jakobs designed it at Darmstadt after producing the Rhönadler and Rhönbussard.

But this Rhönsperber was left exposed to the elements during the War and its remains were thought too unairworthy to be worth resuscitating. However, on visiting Lee-on-Solent this spring I saw it there in a partially reconstructed state and learned that Mr. R. R. Pinniger, ground engineer to the Portsmouth Naval Gliding Club, had been on the job, though a spell in hospital had held him up.

Now Mr. Pinniger is happily in circulation again and told me, when I was there on Jly. 14, that he will soon carry on with the Rhönsperber but that all the woodwork will have to be replaced, since only the metal fittings are in condition to be used again.

Mr. Pinniger's aviation career began more than half a century ago with Handley Page at Barkingside. I asked him what became of the artificial hill, about 25 ft. high, put up on the firm's flying ground in 1909 specially for "gliding experiments." He said it had been removed quite soon, probably before the First World War, because it got in the way of the aeroplanes. Actually, the flying ground was 2½ miles long and a mile wide, but evidently that did not give enough room for the aviators of that day to avoid an obstacle.

* * *

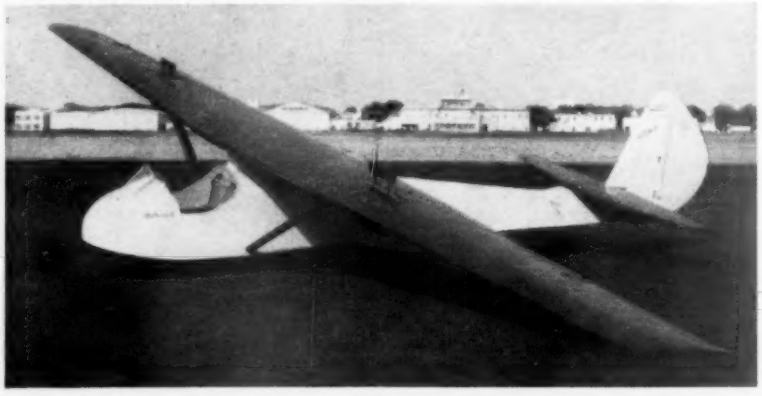
FOLLOWING the Ashvini, an Indian-designed tandem two-seater with swept-forward wings, the first Indian-designed side-by-side two-seater has now appeared under the name of Rohini. It has the same designer, Shri S. Ramamritham, of the Technical Centre of the Civil Aviation Department, and he has incorporated the same tail surfaces and air brakes in both machines.

The front end has a rather similar appearance to that of the T-21, with single struts to the wings, which are of 54 ft. 4 in. span compared to the Ashvini's 58 ft. The wing loading is 4.83 lb./sq. ft. and the stalling speed 30 m.p.h. Best gliding angle is given as 1 in 22 at 48 m.p.h., and minimum sink 2.85 ft./sec. at 38 m.p.h.

The Rohini is, of course, intended for training. It has been built as far as possible with indigenous materials such as Himalayan spruce and white cedar plywood.

* * *

WEST WALES Gliding Association, which flies from Haverfordwest Aerodrome in Pembrokeshire, has had a visit from Peter Scott, who managed 80 minutes in cloud lift in his Olympia 419 on a day which looked completely "duff" apart from a weak sea-breeze front. Gilroy Phillips, the chairman, writes that they have 50 members. Flying began last Christmas with a T-21b two-seater, and now 12 founder members have gone solo on the club's Swallow.



"Rohini," the first Indian-designed side-by-side two-seater sailplane intended for training.

Correspondence

Controlling the Customers

SOME time ago I read an article about Gatwick Airport in the magazine *Architectural Review*, and I remember noticing that the piers or fingers (only one of which has been built) serving the aircraft had their roofs specially designed to provide an excellent observation platform for the public.

I was, therefore, very surprised to see on page 38, Jly. 13 issue of your magazine, a photograph of the swing doors leading from the lounge to the roof of the finger with the notice "No Admittance to the Public" inscribed on them. In view of the fact that this was just exactly what it had been designed for, this limitation seems very frustrating and stupid, and yet another example of petty officialdom.

Surbiton. W. I. D. JORDAN.

On Backward-facing Seats—1

I WAS rather moved by your brief report (Jly. 13) of a Federal Aviation Agency conference on rearward-facing seats.

The airline's spokesman who "quoted" a Cornell University study to show that accelerations in various directions can be produced in a crash, should have added that the rearward ones can be 10 times as great as any of the others. The give-away was in the Lockheed Aircraft Corpn. estimate that converting current aircraft types to rearward-facing seats would cost £1 million in 10 years' operations, due to the increased weight of *stronger floor fixings*. Of course, this is because forward-facing passengers themselves fail at lower decelerations than rearward-facing ones.

Most cynical of all was the airlines' objection to the Armed Forces Institute of Pathology statement that very few passengers dislike rearward-facing seats, on the grounds that the passengers were given the facts before being asked to form an opinion!

Surbiton. R. C. ABEL.

On Backward-facing Seats—2

YOUR short report on the recent conference held by the Federal Aviation Agency concerning rear-facing seats is full of views which those who use the airlines frequently, indeed all who are concerned about air safety, would like to see discussed again, and more fully, in your journal.

I should like to comment on, and question, the points as they arise in your report:

(1) "The Air Transport Association said there was evidence that rear-facing seats could be more dangerous than conventional seats." Assuming a correctly designed seat, giving support to head and body, and with suitably stressed attachment points, it would be interesting to learn from what source the danger comes and to what percentage of cases the evidence applies.

(2) "A NASA spokesman said that seat direction did not appear to be a major solution." What then is the theory behind the design of the astronaut's seat and the reversal of the capsule's attitude before firing retro-rockets? Surely to spread the retarding forces as widely as possible and in the optimum direction.

(3) "The Aerospace Industries Association, whilst supporting further research, doubted that rear-facing seats offered any real increase in safety." This seems to be a more enlightened form of (1) above.

(4) The Airline Pilots' Association understandably wants to spend more money on improving airports and landing aids—prevention of accidents would eliminate the need for such a safety aid. But is it too pessimistic to assume that accidents will go on happening and, given present trends in aviation, the number of passengers involved will increase though the accident rate may decrease?

(5) The Cornell University contribution raises more points than there is space to discuss here. All would agree, on the score of seat floor attachments and of the strength of safety belts. Could one agree as to design of belts? I suggest not. The widely used lap-strap is possibly a compromise between providing some restraint and the wish to avoid alarming passengers by using a more effective but more complicated type of belt. To my mind the lap-strap is inadequate in that it cannot check violent movement of the upper part of the body and so prevent head impact which accounts, I believe, for a high percentage of accident fatalities.

(6) As to the Lockheed Aircraft Corporation's estimate (£1m. over 10 years) of additional operating costs resulting from the fitting of stronger floor attachments, one could argue with conviction that £100,000 annually is good insurance value—if indeed one can place an assessment at all on the value of a human life. If out of a total passenger complement of, say, 100, as few as 40 were saved as a result of rear-facing seats, the cost per head would be £2,500 . . . a year's salary?

Cost may be a problem and so is the instinctive dislike which many people feel for travelling with their backs to the direction of motion; but if the airlines in concert devoted to the selling of this safety factor the same high pressure advertising as is devoted to far less worthwhile ends in the commercial world I, for one, feel convinced that the additional costs would be accepted as money well spent.

Walsham-le-Willows. STANLEY BERRY.

Groundabout

Big Blow. With the help of Coventry's high winds, the caravan used by the judges of the Lockheed Aerobatic Competition had a go at the event by taking off and doing a half-roll before stalling in. The judges inside it, with British fairmindedness, didn't award themselves a place. One of them, Bill Bedford, is more than ever convinced that the safest place is inside an aeroplane. As a passenger, he's been in three car accidents, now this. He swears he wasn't flying it.

*

Too Much is Enough. A zealous salesman of computers, inspired by our need to export, is reported to have told a potential foreign customer: "Absolutely flawless and infallible—you'll get 365 days' annual utilization out of it—and that's a conservative estimate."

*

Finger on Pulse. Every Serviceman knows that apoplexy is an occupational hazard confronting any Command H.Q. staff. But when during recent medical examinations at an R.A.F. station overseas, *four* senior officers from the nearby H.Q. were found to have dangerously high blood pressure, anxiety was rife. Specialist's opinion was sought. He put his finger on the trouble right away. He diagnosed a blockage—in the recording instrument.

*

The Language of Space. Young Wren, whose reading takes in "The Eagle," thinks you'll be interested to know that Dan Dare, Pilot of the Future, is so perplexed by the Solid-Space Mystery that he's sunk to using such dastardly epithets as "Suffering satellites!" and even "Galloping galaxies!"

*

Stop Press. A signal from my Gatwick agent: "Since Peter Masefield's photographs of Gatwick's negative signs were published in AE. and AS., these two new signs have been put up":

by Wren

Industry Record

The Don fueller tops up the tanks of the prototype Boeing-Vertol 107 during its visit to this country last month.

Refuelling Small Aircraft

To a performance specification prepared by Shell-Mex and B.P., Ltd., a unit designed specifically for the fuelling of light aircraft and helicopters has been designed and built by Zwicky, Ltd., of Slough. Known as the Don it is able to carry and dispense all grades of aviation gasolene and turbine fuels from two compartments via two separate sets of equipment. This is done at rates of up to 75 gal. per min. per circuit.

The pumping equipment and associated pump drives are housed in a compartment between the vehicle cab and the tank. The latter is of 1,000 gal. capacity having two Epikote-lined compartments each containing 500 gal. A double division plate isolates one from the other. The tank is mounted on a 7-ton forward-control Bedford chassis powered by a diesel engine.

Each circuit is conventional in that fluid drawn from the tank via a suction filter is pumped by a positive displacement pump through a filter with integral air separator to the meters and thence to the hose reel. This carries a 90-ft. × 2-in. bore fuelling hose.

Test Link

The growing market for environmental test systems in Europe has brought about a link-up between Pye, Ltd., and Ling-Temco Electronics Inc., of Dallas, Texas. Pye, represented by the vibration division of its subsidiary W. Bryan Savage, Ltd., and Ling-Temco, through its Ling Electronics and Calidyne divisions, a leading producer of vibration and accoustic test systems in the U.S., have formed a new company, Pye-Ling, Ltd. This is to market both the Savage and Ling ranges of test equipment.

Precise Temperature Control

Used as a temperature controller for aircraft windscreens, the Type 4 precision temperature controller produced by the Plessey Co., Ltd., has now, says the company, reached the stage of development where it is accurate to within ±1° C. over a temperature range of −40° C. to +85° C. This enables use of the unit to be extended to applications in the chemical, plastics and other fields.

Headset Developments

In the past week we have received news of three new developments by Airmed, Ltd., of Harlow. These are a headset tester, a detachable boom microphone unit for crash helmets and a small transistor lead amplifier.

Intended for the quick and easy serviceability checking of complete headsets and boom microphones, either by aircrew or maintenance personnel, the headset tester comprises a fully stabilized transistor amplifier for testing microphones. By plugging in one or more headsets, faults such as low output, distortion, intermittent operation and open circuits are readily detected. Operation is by mains or batteries. Completely self-contained in a case measuring 8 in. x 6 in. x 5 in., the tester weighs less than 5 lb.

Development of a detachable boom microphone unit for use with the current type of crash helmet in service with the R.A.F. and Fleet Air Arm has now been completed by Airmed and it is also available commercially. Originally designed for use with the Gannet, it has been developed in conjunction with the R.A.E. radio department for use in Service aircraft which require crew intercom. together with noise exclusion and head protection.

The unit consists of a moulded nylon box containing a sensitivity reducing attenuator and a manually operated switch to which is attached an Airlite headset-type of universal "all-position" boom adjustment mechanism. It is fixed to the helmet by a spring clip and can easily be detached or jettisoned in an emergency.

The small transistor lead amplifier mentioned is intended as a means of securing fleet standardization between receivers and headsets. It enables headsets with electromagnetic type microphones to be used in equipment designed for carbon microphones. The amplifier with its two transistor stages is contained in a moulded nylon box which incorporates a 4-way jack plug and also a jack socket to take the headset plug. A quantity of these amplifiers together with Airlite headsets have been ordered by Aer Lingus to re-equip its Viscounts, Friendships and Boeing 720s.

Alloy Steels Furnace

What is claimed to be the largest electric arc melting furnace in the United Kingdom was put into commission on Jly. 7 at the River Don works of the English Steel Corporation, Ltd. It is intended for the production of special alloy steels.

The furnace was designed and built by Birlec-Efco (Melting), Ltd., and has a shell diameter of 21 ft., and an electrical rating of 20 MVA. It is capable of melting a 90-ton charge in less than three hours. Power is supplied by a 20-MVA A.E.I. transformer.

Bearings Subsidiaries

The Glacier Metal Co., Ltd., has announced that arrangements for the formation of subsidiary companies in New Zealand and South Africa, to manufacture plain bearings for those markets, are well under way. Production in both countries, it is expected, will begin in 9-12 months' time.

For Aluminium Users

Just published by the Aluminium Development Association is a new edition of its "Directory of Members with Index of Products." As part of the programme of redesign for all A.D.A. publications, presentation is somewhat different to previous editions; the directory has also undergone considerable modification and expansion of content.

The publication is now divided into two parts, the first of which is the Index of Products section. Here a user of aluminium requiring it in a certain form such as castings, sheet, foil, etc., can readily find full details of A.D.A. member companies who are able to meet his specific requirements. He is referred by page number to the second part of the book where full particulars of these companies are set out. Copies are available, free of charge, from the Association at 33 Grosvenor Street, London, W.1.

Ultra Contracts

An order worth approximately £8,400 for parts and replacements for the SARAH equipment used by the South African Air Force has been received by Ultra Electronics, Ltd., through its agents, the Astra Aircraft Corporation.

Ultra has also received an order from Rolls-Royce, Ltd., for an initial quantity of its Type A609 speed and temperature control amplifiers for use on the Conway R.Co.42 engines for the VC 10. This is worth approximately £17,000.

Aviation Calendar

Jly. 27

Kidlington.—International Business and Touring Aircraft Competition; until Jly. 29.

Oslo.—Eleventh AGARD General Assembly on "Scientific Goals of Space Exploration and Research;" until Jly. 28.

Jly. 31

Oslo.—AGARD Avionics Panel Technical Meeting on "Low Noise Electronics;" until Aug. 2.

Aug. 1

Italy.—Italian Gliding Championships; until Aug. 13.

Company Notices

NEW COMPANIES

Air Engine Sales, Ltd. (697,485).—Private co. Reg. Jly. 5. Cap. £100 in £1 shrs. To carry on the business of aeronautical experts. Reg. off.: 5 Grafton Street, W.1.

J. L. W. Ellis, Ltd. (697,204).—Private co. Reg. Jly. 3. Cap. £100 in £1 shrs. To carry on the business of aviation advisers. Directors: Jacques L. W. Ellis, and Mrs. Margaret R. Ellis, both of Ye Shambles, High Street, Castle Camps, Cambs; Derek R. G. Crosby, 59 Belstead Road, Ipswich. Sec.: Mrs. M. R. Ellis. Reg. off.: Ye Shambles, High Street, Castle Camps, Cambs.

Moule Engineering Co., Ltd. (697,217).—Private co. Reg. Jly. 3. Cap. £25,000 in £1 shrs. To carry on the business of mechanical, automotive and aeronautical engineers. Directors: John A. Hawkings and Marion Hawkings, both of 7 Arnison Road, East Molesey. Sec.: R. E. Andersen. Reg. off.: 17 Half Moon Street, W.1.

OVERSEAS COMPANY

Independent Airlines Association (F.5065).—Particulars filed Jly. 3, 1961. Cap. 100 shrs. without par value. Reg. in State of Delaware, U.S.A., in March, 1953. British address: 3 London Wall Buildings, E.C.2, where Bryan C. Peers is authorized to accept service of process and notices.

CHANGE OF NAME

British Air Navigation Co., Ltd. (519,800). 35 Piccadilly, W.1.—Name changed to British United Airways (Services), Ltd., on Nov. 23, 1960.

INCREASE OF CAPITAL

World Wide Aviation, Ltd. (664,369). Woodpeckers, Prince Consort Drive, Ascot, Berks. Increased on Jly. 28, 1960, by £1,000, in £1 ordinary shrs., beyond the registered capital of £1,000.

New Patents

APPLICATION ACCEPTED

876,438.—**Blackburn Aircraft, Ltd., C. W. Prower, and P. E. G. Hand.**—"Wings of Aircraft." Jan. 29, 1960.

Printed specifications of the above will be available on Aug. 30, 1961, and the opposition period will expire on Nov. 30, 1961.

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camera in the sky

BY CHARLES SIMS

PREFACE BY AIR CHIEF MARSHAL SIR JAMES ROBB

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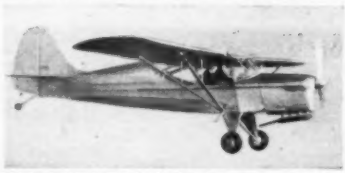

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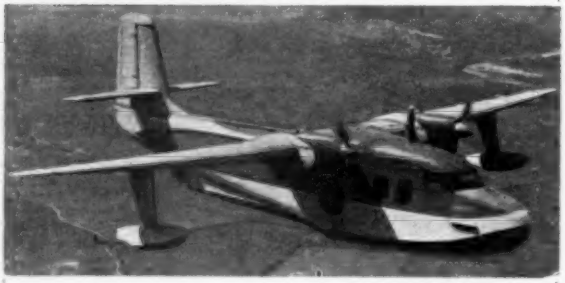

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